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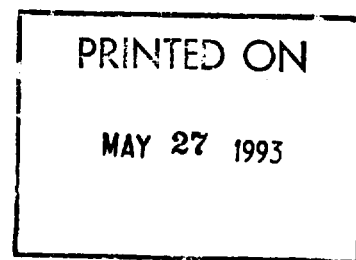
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# **REMEDIAL CONSTRUCTION WORK PLAN**

## **VOLUME III**

- APPENDIX C - CONSTRUCTION SPECIFICATIONS  
GROUNDWATER TREATMENT SYSTEM**
- APPENDIX D - QUALITY ASSURANCE PROJECT PLAN  
GROUNDWATER TREATMENT SYSTEM**
- APPENDIX E - CONSTRUCTION SPECIFICATIONS  
GROUNDWATER EXTRACTION SYSTEM**
- APPENDIX F - QUALITY ASSURANCE PROJECT PLAN  
GROUNDWATER EXTRACTION SYSTEM**

**Summit National Superfund Site  
Deerfield Township of Portage County, Ohio**



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GROUNDWATER EXTRACTION SYSTEM**

**Summit National Superfund Site  
Deerfield Township of Portage County, Ohio**

**MAY 1993**

**REF. NO. 2372 (52)**

This report is printed on recycled paper.

**CONESTOGA-ROVERS & ASSOCIATES**



APPENDIX C

CONSTRUCTION SPECIFICATIONS  
GROUNDWATER TREATMENT SYSTEM



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## SECTION 01010 - SUMMARY OF WORK

### 1. SCOPE OF WORK

The Works to be performed under this Contract consist of construction of Groundwater Treatment System and associated work at the Summit National Superfund Site, Deerfield Township, Ohio.

### 2. LOCATION

The Site is located on the southeastern corner of the intersection of U.S. Route 224 and Ohio Route 225, in Deerfield Township of Portage County, Ohio.

### 3. ACCESS TO SITE

Access to the Site is available from Route 224.

The Contractor shall make all arrangements with the authorities having jurisdiction for the movement of his material and equipment to and from the Site over public roadways.

### 4. DESCRIPTION OF WORK

Work includes, but is not necessarily limited to, the following:

1. mobilization of construction facilities, materials, equipment, plant and personnel necessary to perform the Works;
2. development, implementation and maintenance of a Site-specific Health and Safety Plan;
3. grading Site support areas and placing clean imported gravel in support areas;
4. demolition of existing coal tipple structure, loading and haulage of the rubble to designated spoil area;
5. construction of vehicle decontamination facility;
6. loading and haulage of stockpiled sediment and debris to designated spoil area;
7. grading and preparation for construction of groundwater treatment facility;
8. partial pond dewatering, sediment removal and backfilling for construction of the groundwater treatment building;
9. construction of a groundwater treatment building and foundations;
10. supply and installation of underground septic holding tank and piping;
11. supply and installation of treatment equipment including tanks, pumps, pipes, valves and fittings;



12. supply and installation of electrical, instrumentation and control equipment;
13. supply, installation and connection of electrical power service and telephone service;
14. construction of treated water discharge pipeline and rip-rap outfall;
15. supply and installation of two-foot deep final soil cover, including topsoiling and vegetating, within the work area;
16. installation of new truck access gate in existing perimeter security fence;
17. grading for construction of driveways, parking areas, access roads and rip rapped treated water discharge area as shown on the Drawings;
18. start-up and commissioning of the treatment systems; and
19. demobilization and project closeout.

5. WORK NOT INCLUDED

The following items of work associated with the project do not form part of this Contract:

1. Installation of groundwater extraction system.
2. Treatment of contaminated soils and sediments.
3. Installation and abandonment of wells.

6. CONSTRUCTION SCHEDULE

The Contractor shall perform the Works in accordance with the following construction schedule:

1. the Works shall be commenced at the Site within seven (7) calendar days of the date of the Notice to Proceed; and
2. the Works shall be completed within 285 calendar days from the date of the Notice to Proceed.

7. DRAWINGS

Drawings issued with and forming part of the Contract Documents are listed below. Such Drawings are issued for bid purposes only.

<u>Drawing No.</u>	<u>Rev. No.</u>	<u>Date of Drawing or Latest Revision</u>	<u>Title</u>
C1	0	May 1993	Existing Conditions
C2	0	May 1993	Site Work
C3	0	May 1993	Site Grading Plan
C4	0	May 1993	Typical Sections
C5	0	May 1993	Site Work Details
C6	0	May 1993	Erosion Control
C7	0	May 1993	Chemical Unloading Pad
C8	0	May 1993	Foundation Plan
C9	0	May 1993	Floor Plan
C10	0	May 1993	Foundations Sections and Re Bar Detail
C11	0	May 1993	North and East Elevations
C12	0	May 1993	West and South Elevations
C13	0	May 1993	Building Cross Sections
C14	0	May 1993	Roof Plan
C15	0	May 1993	Room Schedule
C16	0	May 1993	Process Equipment Layout
C17	0	May 1993	Mechanical Sections "B" and "C"
C18	0	May 1993	Mechanical Sections "A" and "D"
C19	0	May 1993	Hydraulic Gradient
C20	0	May 1993	HVAC and Plumbing
C21	0	May 1993	Site Electrical Service
C22	0	May 1993	Lighting and Receptacles
C23	0	May 1993	Motor and Disconnect Location
C24	0	May 1993	MCC Layout and Power Diagram
C25	0	May 1993	PLC and I/O Layout
C26	0	May 1993	I/O Cabinet and Control
C27	0	May 1993	Process and Instrumentation Diagram

The Contractor shall perform the Works in accordance with Drawings signed "Approved for Construction" by the Engineer. Such Drawings will be issued to the Contractor after award of the Contract and will consist of bid Drawings revised as required by the Engineer and additional Drawings if required by the Engineer.

Revised "Approved for Construction" Drawings may be issued from time to time by the Engineer and such Drawings shall supersede previous revisions. If revised "Approved for Construction" Drawings are issued which necessitate changes to the Contractor's shop drawings not yet reviewed, no separate payment will be made for the Contractor's expenses involved in revising such shop drawings.

#### 8. MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for work under Section 01010.

END OF SECTION

## SECTION 01015 - GENERAL REQUIREMENTS

### 1. PROJECT STARTUP

Prior to mobilizing to the Site, the Contractor shall provide all bonds and insurance as required by the Contract Documents and to the satisfaction of the Engineer.

Prior to commencing work at the Site, the Contractor shall mobilize all material and equipment required for performance of the Works; erect all temporary fencing; provide all construction facilities and temporary controls including parking areas, all necessary connections to power, water, telephone and sewer and access roads as required.

The Contractor shall site all construction facilities in areas designated by the Engineer. Any changes to the locations of construction facilities shall be approved by the Engineer.

The Contractor shall ensure all utilities and surface features potentially affected by the Works are located in and around all active work areas prior to commencement of the Works.

The Contractor shall ascertain and record the conditions of existing surface features at all work locations under this Contract.

### 2. CONTRACTOR'S REPRESENTATIVE

During the performance of the Works, the Contractor shall have on the Site during working hours a designated Superintendent empowered to act on behalf of the Contractor in all matters pertaining to the Contract. The Contractor shall within seven days of execution of the Contract, nominate such person or persons, in writing, to the Engineer. Such person or persons shall remain, in the context of this Contract, the Contractor's designated agent(s) until such time as notification to the contrary is received in writing by the Engineer.

### 3. MEASUREMENT METHODS

Further to Article 7 of the Agreement, measurement clauses in these Project Specifications define methods the Engineer will use to determine quantity of completed work for payment purposes.

The Contractor shall notify the Engineer sufficiently in advance of operations to permit required measurements for payment and shall provide reasonable and necessary opportunities and facilities for making such measurements.

The Contractor shall provide at his own expense a qualified assistant(s) to the Engineer to expedite the taking of these measurements and to facilitate agreement on pay item quantities.

### 4. DELIVERY OF EQUIPMENT AND MATERIAL

No material or equipment of any kind shall be delivered to the Site until approval in writing has been applied for and obtained by the Contractor from the Engineer that such material or equipment may be delivered.

The Contractor shall ensure that the delivery of material and equipment to the Site is coordinated with the work sequence and stored in areas approved by the Engineer. Delivered equipment and material shall be protected from contamination prior to and during use in the Works.

5. OTHER CONTRACTORS

Other Contractors may be working on the Site. The Contractor shall cooperate with and coordinate his activities with Other Contractors. No additional payment will be made for delays, changes in schedule, or any other work due to the fact that Other Contractors are working on the Site.

6. QUALITY CONTROL

A. INSPECTION

The Engineer shall have access to the Works. If parts of the Works are in preparation at locations other than at the Site, the Contractor shall provide access to such work whenever it is in progress.

The Contractor shall give timely notice requesting inspection if work is designated for special tests, inspections or approvals or by instructions of the Engineer or other authorities having jurisdiction.

If the Contractor covers or permits to be covered any part of the Works that has been designated for special tests, inspections or approvals before such is made, the Contractor shall uncover such work, have the inspections or tests satisfactorily completed and make good such work at no additional cost to the Trust.

The Engineer may order any part of the Works to be examined if such work is suspected to be not in accordance with the Contract Documents. If, upon examination such work is found not in accordance with the Contract Documents, the Contractor shall correct such work and pay the cost of examination and correction. Except as specified above, if such work is found to be in accordance with the Contract Documents, the Trust will pay the cost of examination.

B. INDEPENDENT TESTING AGENCIES

Independent testing agencies may be engaged by the Trust for the purpose of inspecting and/or testing portions of the Works.

The Contractor shall allow inspection/testing agencies access to the Works whenever it is in preparation or progress and shall provide reasonable facilities for such access.

Employment of testing agencies by the Trust does not preclude or relax the responsibility of the Contractor to perform as specified.

If defects or deficiencies are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain the full degree of the defect or deficiency. The Contractor shall correct defects and deficiencies as directed by the Engineer at no additional cost to the Trust.

The Contractor shall pay costs for retesting and reinspection.

C. PROCEDURES

The Contractor shall notify the appropriate agency and the Engineer in advance of the requirement for tests, inspections or approvals, in order that attendance arrangements can be made.

The Contractor shall submit samples and/or materials required for testing, as specifically requested in the Project Specifications. The Contractor shall submit with reasonable promptness and in an orderly sequence so as not to cause delay in the performance of the Works.

The Contractor shall provide labor and facilities to obtain and handle samples and materials at the Site.

D. REJECTED WORK

The Contractor shall remove defective work, whether the result of poor workmanship, use of defective products or damage and whether incorporated in the Works or not, which has been rejected by the Engineer as failing to conform to the specified requirements.

The Contractor shall make good Other Contractor's work damaged by such removals or replacements promptly.

If in the opinion of the Engineer it is not expedient to correct defective work or work not performed in accordance with the Contract Documents, the Trust may deduct from the Contract Price the difference in value between the work performed and that called for in the Contract Documents, the amount of which shall be determined by the Engineer.

7. EXISTING CONDITIONS

Prior to commencement of work at the Site, the Contractor shall inspect the Site with the Engineer to review and establish the condition of all surface features including existing buildings, trees and other plants, grassed areas, fencing, service poles, wires, paving and survey bench marks or monuments on or adjacent to the Site which may be affected by the Works. This inventory shall be mutually agreed between the Engineer and the Contractor and shall not thereafter be subject to dispute. Such inventory as may be amended, from time to time, will be used by the Engineer to check compliance by the Contractor with the requirements of the Contract Documents.

The Contractor shall provide ongoing review inspection and attendance during performance of the Works to properly document conditions. The Contractor shall inform the Engineer within seven (7) calendar days of any existing conditions at the Site affected by the Works which may require restoration, repair or replacement. The Contractor shall not cover up any of the Works without prior approval from the Engineer.

The Contractor shall protect existing buildings and other surface features from damage which may be affected by the Works while work is in progress and repair any resulting damage from the Works to the Engineer's approval.

8. RESTORATION

A. GENERAL

This Clause describes minimum requirements and not necessarily all the requirements for restoration work.

The Contractor shall supply all labor, materials and equipment and do all work necessary or required to restore the Site as specified and shown on the Drawings.

Restoration shall mean replacement, repairs or reconstruction to a condition at least as good as or better than the condition prior to commencement of the Works.

Except where specifically required by other Sections of the Project Specifications, the Contractor shall restore areas of the Works and areas affected by the performance of the Works to conditions that existed prior to commencement of the Works and to match condition of adjacent, undisturbed areas.

The Contractor shall be responsible to restore the Site, including all areas affected by the performance of the Works, and shall utilize construction methods and procedures during the performance of the Works which keeps disturbance and damage of whatever nature to existing conditions to the practical minimum. Where the works necessitate root or branch cutting, the Contractor shall do so only as approved by the Engineer.

Unless specified otherwise, the Contractor shall ensure that quality, grades, elevations and extent of bedding, backfill and other materials including subgrades, finish grades, thickness of pavements for roadways and parking areas are properly documented during their removal to ensure reconstruction to at least their original and functional condition.

B. MATERIAL

Material required for restoration work shall be provided by the Contractor subject to the approval of the Engineer prior to use.

Restoration material shall be new, except as otherwise specified, not damaged or defective and of the best quality for the purpose intended. If requested by the Engineer or specified in other Sections of the Project Specifications, the Contractor shall furnish evidence as to type, source and quality of materials or products provided.

Should any dispute arise as to the quality or fitness of materials, whether obtained on the Site or off the Site, whether previously inspected by the Engineer prior to use or not, the decision to use any material or product in the finished Works will rest strictly with the Engineer.

Material not approved for reuse shall become the property of the Contractor and shall be removed from the Site.

The Contractor shall handle and store products or materials in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

C. PERFORMANCE

The Contractor shall notify the Engineer sufficiently in advance of any required attendance to assess and/or document existing conditions.

Prior to commencement of restoration work, the Contractor shall inform the Engineer of proposed material, methods and procedures to repair, replace or reconstruct any disturbed, damaged or suspected damaged to areas of the Works.

The Contractor shall perform cutting, remedial and coordination work required to make the parts of the Works fit together.

The Contractor shall ensure that restored areas match existing grade and surface drainage characteristics, except as otherwise specified, and ensure a smooth transition from restored surfaces to existing surfaces.

The Contractor shall not alter original conditions without approval from the Engineer.

The Contractor shall dismantle and/or salvage materials for reuse where practicable except as otherwise specified. The Contractor shall exercise due care when removing material for salvage. Materials damaged through improper handling or through loss after removal shall be repaired or replaced by the Contractor at no additional cost to the Trust.

The Contractor shall store and protect removed material approved for reuse in approved locations.

Unless otherwise specified, restoration of pavement shall be made by removing and replacing the entire portions between joints or scores and not merely refinishing or patching localized areas.

In removing pavements, curbs and gutters and similar structures or surfaces, the Contractor shall saw cut surfaces and protect adjacent joints and load transfer devices and underlying granular materials.

9. LAYOUT

The Engineer will establish reference bench marks and baselines adjacent to the Works.

The Contractor shall be responsible for the preservation of all survey reference points as set or established by the Engineer. Any errors entering into the Works through failure of the Contractor to notify the Engineer concerning lack of preservation of such survey reference points shall be made good by the Contractor at no additional cost to the Trust.

The Contractor shall develop and make such additional detailed surveys as are needed for construction, such as slope stakes, line and grade stakes for forcemains, batterboards, stakes for establishing the design elevations of the working points, lines and elevations. All bench marks, base lines, property boundaries, line and grade hubs, and other references and construction points, and such survey points shall thereafter be maintained by the Contractor.

The Engineer may, at any time, check the Contractor's survey and layout work but this shall not relieve the Contractor of any of his responsibilities to carry out the Works to the lines and grades as set out in accordance with the Drawings and Project Specifications.

The Contractor shall provide reasonable and necessary opportunities and facilities for setting points and making measurements during construction. The Contractor shall not proceed until he has made request to and has received from the Engineer, such points as may be necessary as the work progresses. The construction shall be done in conformance with such points.

10. WORK AREAS

The Trust will provide the right of access to certain lands in connection with the Works. The Contractor shall not unreasonably encumber these premises with its plant, equipment or materials. No other areas on the Site shall be used by the Contractor without the Engineer's written approval.

11. LANDS BY CONTRACTOR

The Contractor shall provide, with no liability to the Trust, any additional land and access thereto not shown or described that may be required for temporary construction facilities or storage of materials. The Contractor shall construct and maintain all access roads, detour roads, or other temporary work as required by its operations. All such areas shall be approved by the Engineer prior to construction.

12. COORDINATION WITH ADJACENT OPERATIONS

The Contractor is advised that operations of facilities adjacent to the Site must be maintained (to the maximum extent possible) throughout the execution of the Works. The Contractor shall arrange and perform all work in such a manner as to cause minimum interference to adjacent operations or personnel.

13. DISRUPTION OF SERVICES

Where it is necessary to interrupt existing services, the Contractor shall advise the Engineer a minimum of 72 hours in advance of a proposed shut down or interruption of services, utilities or access to any adjacent facility and shall not proceed with such shutdown or interruption until authorization to proceed has been issued by the Engineer. Where it is necessary to interrupt existing services, all related and preliminary work shall be scheduled and completed in advance, except for necessary final connecting or removal, as the case may be, to ensure minimum shut down time. No additional payment will be made for delays resulting from failure to authorize the interruption within 72 hours or modifications required to the proposed sequence of work to accommodate adjacent operations.

The Contractor shall identify all potentially required shut down or interruptions of service utilities or access to any adjacent facility and expected duration on the Contractor's detailed construction schedule.

The Contractor shall coordinate the Work to ensure alternate access routes, points of entry, or service connections are not interrupted at the facilities located adjacent to the Site.



14. HAZARDOUS WASTE

No waste that is considered to be hazardous, or is subject to regulation under any applicable law, statute, rule, regulation, or ordinance, shall be treated or disposed on the Site except as approved by the Engineer. No such waste shall be stored in violation of any such applicable requirements. Liability and responsibility for any and all hazardous waste produced during the performance of this Contract shall be the sole liability and responsibility of the Contractor.

15. CLEAN UP

No material of any kind shall be removed from the Site without prior approval from the Engineer.

The Contractor shall not allow any part of the Site to become littered with trash and/or waste material, and shall maintain the same in a neat and orderly condition throughout the performance of the Works.

Daily accumulations of solid waste material which have been in contact with contaminated materials, such as discarded safety equipment, debris and rubbish, shall be collected and properly containerized for disposal.

Non-contaminated solid waste materials from the Site offices, lunch room and security office shall be segregated from contaminated solid wastes removed from the work areas.

Non-contaminated solid waste materials shall be removed from the Site in a timely manner or as directed by the Engineer such that accumulation of waste materials at the Site is minimized. Greasy or oily rags or materials subject to spontaneous combustion shall be deposited and kept in approved receptacles for disposal.

On or before the completion of the Works, the Contractor shall carefully clean out all structures including pits, chambers and conduits and shall tear down and remove all temporary structures and facilities provided by him and shall remove rubbish of all kinds from any of the grounds which have been occupied or used and leave them in first-class condition approved by the Engineer.

16. SPECIFIED AND SUBSTITUTE EQUIPMENT

In the Drawings and Project Specifications, the following statements with respect to specified and substitute equipment shall be followed:

1. When a device specified is followed by a manufacturer's name and specific equipment identification without being followed by the words "or equal", then no substitute device is acceptable.
2. When a device specified is followed by two or more manufacturer's names and respective equipment identifications without being followed by the words "or equal", then the device supplied must be from one of those manufacturers named.

3. If a device specification is generic or includes the words "or equal" after a named manufacturer's product, the engineer will decide at the time of shop drawing review whether or not the device intended to be supplied is acceptable.

17. SYSTEM COMMISSIONING

The Contractor shall provide all start-up assistance to test and hydraulically balance the treatment systems.

18. MEASUREMENT AND PAYMENT

A. BONDS

Payment for bonds will be made at the lump sum price stipulated in the Schedule of Prices for Item A-1, which price and payment shall be full compensation for furnishing all bonds required by the Contract Documents.

B. INSURANCE

Payment for insurance will be made at the lump sum price stipulated in the Schedule of Prices for Item A-2, which price and payment shall be full compensation for furnishing all insurance required by the Contract Documents and as required by Federal, State and local agencies having jurisdiction over the Works.

C. MOBILIZATION AND PROJECT STARTUP

Payment for mobilization and project startup will be made at the lump sum price stipulated in the Schedule of Prices for Item A-3, which price and payment shall be full compensation for movement of all equipment, materials, plant and personnel to the Site and within the Site during performance of the Works; provision of all necessary permits; provision of all Contractor required facilities; provision of all required utilities; construction of access roads to work areas, including detours, where required; and all other miscellaneous items for which separate payment is not provided under other Items.

D. SYSTEM COMMISSIONING

Payment for system commissioning will be made at the lump sum price stipulated in the Schedule of Prices for Item A-4 which price and payment shall be full compensation for startup assistance including all plant and materials; manpower; testing equipment and all other items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 01121 - HEALTH AND SAFETY

### 1. GENERAL

#### A. GENERAL REQUIREMENTS

##### (1) Scope of Work

Work of this Section consists of the development, implementation and maintenance of a written Site-specific Health and Safety Plan.

The Contractor shall develop the Site-specific Health and Safety Plan prior to commencing any on-Site work involving excavation of contaminated soils and sediments, ground invasive activities in contaminated grid squares and below two feet in uncontaminated grid squares and shall continue to implement, maintain and enforce the plan until final project closeout.

Personnel engaged in any on-Site work involving excavation of contaminated soils and sediments, ground invasive activities in contaminated grid squares and below two feet in uncontaminated grid squares shall be OSHA trained in accordance with 29 CFR 1910.120. Personnel engaged in other Site activities need not be OSHA trained.

The development, implementation and maintenance of the Site-specific Health and Safety Plan is the Contractor's sole responsibility. The Contractor's Site-specific Health and Safety Plan shall, as a minimum, address the specifications contained herein.

The health and safety guidelines contained herein are intended to provide for a safe and minimal risk working environment for on-Site personnel and to minimize the impact of activities involving contact with any hazardous materials or hazardous wastes on the general public and the surrounding environment.

Should the Contractor seek relief from or substitution for any portion or provision of the minimum health and safety guidelines specified herein or the reviewed Site-specific Health and Safety Plan, such relief or substitution shall be requested of the Engineer in writing, and if accepted by the Engineer, will be authorized in writing.

The Contractor is responsible for the safety of persons and property on the Site and for the protection of persons off the Site and the environment to the extent that they may be affected by the conduct of the Works. The Contractor shall comply with and enforce compliance by its employees and the employees of all of its Subcontractors, agents and invitees, with all safety requirements of the Contract Documents, all applicable federal, state and local statutes, regulations and ordinances, and with its Site-specific Health and Safety Plan. The Contractor acknowledges that safety and environment protection obligations are of paramount importance regarding all of the work performed under the Contract Documents.

##### (2) Basis

The Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926

(29 CFR 1910 and 1926) shall provide the basis for the health and safety program. The program shall also reflect the position of the USEPA and NIOSH regarding procedures recommended or required to ensure safe operations at sites containing hazardous or toxic materials.

(3) Site Characterization

Work at the Site will involve contact with contaminated materials. A list of known chemicals at the Site as determined by USEPA is provided in the Trust's Health and Safety Plan for the Site which is included in Attachment C.

(4) Related Work Specified In Other Sections

The following items of work associated with the work of this Section are specified in other Sections as noted:

1. Provision of personnel support and hygiene facilities, Section 01500.

B. SUBMITTALS

(1) Contractor's Site-Specific Health and Safety Plan

Within (7) seven calendar days of the date of Notice to Proceed and prior to mobilization to the Site, the Contractor shall submit to the Engineer a Site-specific Health and Safety Plan for review. The submitted Site-specific Health and Safety Plan shall address, as a minimum, all aspects of worker protection and measures designed to prevent migration of hazardous or contaminated material to the environment, including but not limited to the provisions and guidelines contained herein. Specific topics which must be addressed in the Contractor's Site-specific Health and Safety Plan include:

1. worker medical surveillance;
2. worker training;
3. a detailed description of the planned movement of labor, equipment and materials from and between work areas as work progresses, including measures to be employed to prevent recontamination of previously cleaned areas and contamination of areas that do not now contain hazardous materials;
4. a detailed description of the personnel decontamination facilities to be employed including the planned phasing of decontamination facilities between work areas as work progresses and the methods to be used to collect, store, treat and ultimately dispose of personnel decontamination waters and wastes;
5. a detailed description of the washdown area for decontamination of vehicles and equipment and the methods to be used to collect, store, treat and ultimately dispose of washdown decontamination waters and sediments;
6. confined space entry program and procedures if the Contractor expects confined space work to be performed;

7. drum handling program in accordance with OSHA 29 CFR 1910.120(j) (for sites involving drum characterization activities);
8. personal protective equipment types to be used;
9. personal hygiene and personnel decontamination procedures;
10. respirator protection program and procedures;
11. personnel air monitoring;
12. emergency and first aid equipment and supply;
13. dust and particulate emission control; and
14. monitoring and mitigation of worker heat and cold stress.

The Contractor's Site-specific Health and Safety Plan must be submitted to and reviewed by the Engineer before the Contractor commences Site activities involving the handling or any contact with potentially hazardous waste.

The Engineer will review the Contractor's Site-specific Health and Safety Plan and provide comments to the Contractor within ten (10) days of receipt of the plan. The Contractor shall revise the plan as appropriate and resubmit the plan to the Engineer within seven (7) days of receipt of comments.

Work in the Exclusion Zone or in the Contaminant Reduction Zone (including any areas expected to become an Exclusion Zone or Contaminant Reduction Zone), including work relating to the designation or establishment of an Exclusion Zone or Contaminant Reduction Zone, may not commence until the Contractor's Site-specific Health and Safety Plan is reviewed by the Engineer, USEPA and OEPA. Other on-Site work may be conducted after the submittal of the Site-specific Health and Safety Plan to, and prior to, its review by the Engineer, but any such work shall be conducted only with the prior approval of the Engineer. The Contractor shall be obligated to implement the proposed Site-specific Health and Safety Plan, as submitted to the Engineer, USEPA and OEPA, during the conduct of any work performed prior to the review of the Site-specific Health and Safety Plan. The Trust's Health and Safety Plan for the Site as approved by USEPA is provided in Attachment B for the Contractor's review.

(2) Proof of OSHA Training

Within seven (7) calendar days of the date of Notice to Proceed and prior to mobilization to the Site, the Contractor shall submit to the Engineer a list of all personnel that will be employed throughout this Contract. For each of the listed personnel the Contractor shall provide proof of training for each employee as required under OSHA 29 CFR 1910.120. The Contractor shall submit to the Engineer proof of training for any additional employees, at least seven (7) calendar days prior to the employee's arrival on the Site.

(3) Medical Surveillance

Within seven (7) calendar days of the date of Notice to Proceed and prior to mobilization to the Site, the Contractor shall submit to the Engineer a report for medical examination conducted within the last twelve (12) months as part of compliance with OSHA medical surveillance requirements for each of the Contractor's personnel designated to be working on this Contract. As a minimum, the following information shall be submitted for each Contractor personnel:

1. name and Social Security Number and date of exam; and
2. physician's statement that the worker is approved to wear and use the types of respiratory protection proposed for the project and is able to work safely in hazardous environments capable of producing heat stress in the worker.

The Contractor shall submit to the Engineer reports on medical examination for any additional employees at least seven (7) calendar days prior to the employee's arrival on the Site.

C. JOB CONDITIONS

(1) Work Stoppage

The safety and health of the public and on-Site personnel and the protection of the environment shall take precedence over cost and schedule considerations for all project work. The Engineer and the Health and Safety Officer shall be responsible for decisions regarding when work shall be stopped or started for health or safety considerations and shall each have the authority to stop the work for health or safety considerations. The Health and Safety Officer shall have the obligation to stop the work when, in his discretion, it is necessary or advisable for reasons of health or safety.

(2) Unforeseen Hazards

Should any unforeseen or Site peculiar safety related factor, hazard, or condition become evident during the performance of the Works at the Site, it shall be the Contractor's responsibility to bring such to the attention of the Engineer verbally and in writing as quickly as possible, for resolution. In the interim, the Contractor shall take prudent action to establish and maintain safe working conditions and to safeguard employees, the public, the Owner, the Engineer and the environment.

2. HEALTH AND SAFETY OFFICER

The Contractor shall provide a Health and Safety Officer on the Site during the execution of all work. The Health and Safety Officer shall report directly to and be under the direction of a Certified Industrial Hygienist provided by the Contractor. The Certified Industrial Hygienist shall oversee operations as necessary to ensure the work is performed in accordance with the Site-specific Health and Safety Plan and shall oversee and be present during the Health and Safety Training Session and, as a minimum, complete qualitative respirator fit testing; and oversee the Health and Safety Officer's activities on a part-time basis and be available on an as-needed basis for emergency situations.

The Health and Safety Officer shall:

1. have a minimum of two years site-related working experience specific to the construction activities at the Site;
2. have a sound working knowledge of State and Federal occupational safety and health regulations;
3. have formal educational and/or training in occupational safety and health;
4. be responsible for completing the health and safety training session;
5. be responsible for the implementation and daily enforcement and monitoring of the Site-specific Health and Safety Plan;
6. be responsible for performing air monitoring;
7. ensure that all on-Site personnel have obtained the required medical examinations prior to arrival at the Site and at the termination of their assignment as required;
8. be responsible for the pre-construction indoctrination of all on-Site personnel with regard to the Site-specific Health and Safety Plan and other safety requirements to be observed during construction, including:
  1. potential hazards,
  2. personal hygiene principles,
  3. use of personal protective equipment and respiratory protection, including fit testing, and
  4. emergency procedures for dealing with fire and medical situations;
9. be responsible for incorporating the provisions of both on-Site and off-Site emergency contingency plans in the Site-specific Health and Safety Plan and maintaining a state of readiness to enact the provisions;
10. be responsible for alerting appropriate on-Site and/or off-Site emergency services and the Engineer before starting any particularly hazardous work;
11. assist the Engineer in contacting and advising all local authorities of the Works being performed; and
12. have the authority and obligation to stop all, or any part of the Works if, in his sole discretion, stoppage of the Works is necessary or advisable for considerations of health or safety.

3. PERSONNEL HEALTH, SAFETY AND HYGIENE

A. MEDICAL SURVEILLANCE

The Contractor shall conduct medical surveillance of employees as required by 29 CFR 1910.120 and 29 CFR 1910.134.

The Contractor shall retain the services of a licensed occupational physician or physician's group to provide the medical examinations and surveillance required. All

pertinent Site characterization data, a copy of 29 CFR 1910.120, and a description of the intended personal protective equipment shall be provided to the occupational physician prior to completing medical surveillance. The name of the physician and evidence of examination of all on-Site personnel shall be provided to the Engineer prior to assigning personnel on-Site work activities in the Exclusion Zone or Contaminant Reduction Zone. Contractor personnel medical approvals shall be maintained by the Contractor at the Contractor's Site office for the duration of the Contract.

Medical surveillance protocol shall be the occupational physician's responsibility but shall meet the requirements of OSHA standard 29 CFR 1910.120 and 29 CFR 1910.134 for all personnel. This exam may include:

1. medical/occupation questionnaire with work history;
2. full physical examination;
3. screening audiometric test with otoscopic exam for occlusion or perforation;
4. visual acuity measurement, including color perception;
5. pulmonary function test (Spirometry - FVC and FEV-1.0 second);
6. resting EKG;
7. chest x-ray;
8. blood chemistry profile as deemed appropriate by the attending physician for hazardous waste work;
9. complete blood count with differential and platelet evaluation, including WBC, RBC, HGB, hematocrit;
10. urinalysis with microscopic examination; and
11. other Site-specific medical monitoring as required by Site-specific conditions.

All on-Site personnel requiring full medical surveillance shall be provided with medical surveillance within the twelve (12) month period prior to entering the Site, and at any time there is suspected to be excessive exposure to toxic chemicals or physical agents. On-Site personnel who become due for an annual physical examination will be removed from the work force immediately until medical requirements are met in accordance with 29 CFR 1910.120 and 29 CFR 1910.134.

#### B. TRAINING

The Contractor shall provide and require that all personnel assigned to or entering the Site, complete Site training or refresher sessions. Site-specific training and refresher sessions shall ensure that all personnel are capable of and familiar with the use of safety, health, respiratory and protective equipment and with the safety and security procedures required for this Site. The training session shall be completed by the Health and Safety Officer provided by the Contractor under the supervision of the Contractor's Certified Industrial Hygienist.



The training program shall include, as a minimum, the following items:

1. names and personnel responsible for Site health and safety;
2. Site-specific potential hazards;
3. use of personal protective equipment (PPE), including proper donning and doffing procedures;
4. work practices by which the employee can minimize risks from these potential hazards;
5. confined space entry procedures (if confined space work is to be performed);
6. safe use of engineering controls and on-Site equipment;
7. discussion and completion of medical surveillance requirements and recognition of symptoms associated with exposure to hazards;
8. Site control methods;
9. on and off-Site contingency plans;
10. decontamination procedures;
11. Site-specific standard operating procedures;
12. delineation between work zones;
13. use of the buddy system;
14. scope of the intended work for the Contract;
15. review on-Site communications and appropriate hand signals between personnel working in the Exclusion Zone and/or Contaminant Reduction Zone; and
16. the content of the OSHA standards, including the Appendices.

In accordance with 29 CFR 1910.120, all employees assigned to or entering the Exclusion Zone or Contaminant Reduction Zone (including truck drivers transporting waste material) shall receive training including a minimum of 40 hours instruction off the Site and three (3) days of actual field experience under direct supervision of a trained experience supervisor and an 8-hour annual refresher. The Contractor shall provide documentation stating that all on-Site personnel expected to enter potentially contaminated work areas have complied with this regulation. Each individual's name shall be included on this confirmatory letter.

The Health and Safety Officer shall be responsible for ensuring that personnel not successfully completing the required training are not permitted to enter the Site to perform work in the Exclusion Zone or Contaminant Reduction Zone.

The Contractor shall implement a hazard communication ("Right-to-Know") program in accordance with 29 CFR 1910.1200.

C. LEVELS OF PROTECTION

Levels of protection for each work area shall be established based on planned activity, location of activity and air monitoring results. All potential exposures to hazardous materials shall be monitored with a photoionization device (Oxygen level meter and explosimeter for confined space work).

The level of personal protective equipment (PPE) required in the Exclusion Zone shall be minimum Level C until all wastes have been characterized. Following waste characterization, the level of PPE may be increased or decreased, but will not be less than Level C for all waste handling activities.

The anticipated levels of personal protection based on work activity are as follows:

<i>Work Activity</i>	<i>Anticipated Level of Personal Protection</i>
1. Excavation of Contaminated Soils and Sediments, Ground Invasive Activities in Contaminated Grid Squares, and Below Two Feet in Uncontaminated Grid Squares	C
2. Demolition Activities, Fencing, Construction of Groundwater Treatment Building and Equipment, Site Regrading, Soil Cover Installation	D

D. PERSONAL PROTECTIVE EQUIPMENT

Based on the work activity and the anticipated level of personal protection as specified in Section 01121, Clause 3.C, the Contractor shall provide all on-Site contractor personnel with appropriate personal protective equipment (PPE). The Contractor shall ensure that all safety equipment and protective clothing is kept clean and well maintained. As a minimum, the Contractor shall supply each worker entering or expected to enter the exclusion zone or contaminant reduction zone with protection as specified in Section 01121, Clause 3.C, consisting of the following:

Level C

1. individually assigned half-facepiece or full-facepiece air-purifying respirators (NIOSH approved), with appropriate cartridges for organic vapors and particulates. Respirators should be available at all times and donned when required as indicated by air monitoring;
2. chemical-resistant disposable coveralls (saranex);
3. latex and/or cotton inner gloves;
4. nitrile outer gloves;
5. work boots with steel toe and shank;

6. chemical-resistant overboots or booties, butyl rubber or neoprene;
7. hard hat; and
8. safety glasses and/or chemical-resistant goggles.

Level D

1. hard hats;
2. safety glasses or goggles;
3. long pants and long sleeve shirt;
4. safety boots; and
5. any personal protective equipment necessary for specialized tasks (e.g. welding goggles).

Personal protective equipment usage procedures shall be developed by the Contractor. These requirements shall include, but not be limited to, the following:

1. all prescription eyeglasses in use on the Site shall be safety glasses. Contact lenses shall not be permitted on the Site within the Exclusion Zone or Contaminant Reduction Zone;
2. respirator cartridges/filters shall be changed daily during periods of respirator usage or upon breakthrough, whichever occurs first;
3. footwear used on the Site shall be steel-toed safety shoes or boots and shall be covered by rubber overshoes when entering or working in the Exclusion Zone;
4. all personal protective equipment worn on the Site shall be disposed or decontaminated at the end of the work day;
5. the Health and Safety Officer shall be responsible for ensuring all reusable personal protective equipment is decontaminated before being reissued;
6. on-Site personnel who have not passed a respirator fit test shall not be permitted to enter potentially contaminated work areas and/or the Contaminant Reduction Zone. Personnel shall not be permitted to have facial hair that interferes with a proper fit of the respirator; and
7. all on-Site personnel within active areas shall wear approved PPE including, but not necessarily limited to, hardhats and safety boots.

**E. RESPIRATORY PROTECTION**

All on-Site personnel shall receive extensive training in the usage and limitations of, and be qualitatively fit tested for, half- and full-facepiece respirators in accordance with 29 CFR 1910.134. This shall include both air purifying and supplied air type respirators.

The respirator program shall be developed and implemented by the Contractor and maintained by the Health and Safety Officer. A copy of the respirator program shall be incorporated or attached to the Contractor's Site-specific Health and Safety Plan.

The Contractor shall monitor, evaluate and provide respiratory protection for all on-Site personnel.

Levels of respiratory protection as listed in Section 01121, Clause 3.C have been chosen to be consistent with Site-specific potential airborne hazards associated with the major contaminants identified at the Site. The selection of appropriate protection is based upon the potential presence of compounds with the lowest recommended threshold limit value.

In the absence of additional air monitoring information or substance identification, the following minimum levels of respiratory protection will be required:

<u>Sustained Total Organic Vapor Concentration Above Background (ppm)</u>	<u>Level of Respiratory Protection Required</u>
0 - 1	Half- or full-facepiece respirator available
1 - 5	Half- or full-facepiece air purifying respirator, Level C
>5	Shut-down activities, evaluate the need for Level B or higher respiratory protection

The Contractor shall be responsible for appropriate respiratory protection during all work activities. As a minimum, the Contractor shall ensure that all persons entering the Exclusion Zone or Contaminant Reduction Zone are supplied with and use appropriate respiratory protection.

Assessing the ability for on-Site personnel to wear respiratory protection shall be the responsibility of the Contractor. Cardiopulmonary system examination and pulmonary function testing are minimum requirements and have previously specified in Section 01121, Clause 3.A.

On-Site personnel unable to pass a respirator fit test shall not enter the Exclusion Zone or Contaminant Reduction Zone. Proof of such fitting shall be provided to the Engineer prior to commencing work.

F. HEAT STRESS/COLD STRESS

The Contractor shall implement a heat stress and/or cold stress monitoring program as applicable. Specific components of the Contractor's program shall address:

1. training of employees to recognize and mitigate heat/cold stress situations and symptoms;
2. target conditions which will initiate monitoring of employees;
3. monitoring methods; and

4. the means and methods by which the Contractor will mitigate such conditions.

The Contractor shall base the heat stress/cold stress program on recommendations by ACGIH, NIOSH, and other recognized authorities.

G. PERSONNEL HYGIENE AND PERSONNEL DECONTAMINATION PROCEDURES

The Health and Safety Officer shall be responsible for, and ensure that all Contractor personnel observe and adhere to the personal hygiene-related provisions of this Section.

On-Site Contractor personnel found to be disregarding the personal hygiene-related provisions of the Site-specific Health and Safety Plan or the Project Specifications (including but not limited to the requirements concerning personal protective equipment specified in Section 01121, Clause 3.D; respiratory protection specified in Section 01121, Clause 3.E; and personnel hygiene and personnel decontamination procedures specified in Section 01121 Clause 3.G shall be issued a written notice of such violation. The notice may be issued by the Engineer, the Health and Safety Officer or any supervisory personnel of the Contractor. A copy of the notice shall be given to the offending worker, to his immediate supervisor, to the Contractor's Superintendent and to the Engineer. Upon issuance of a second written notice of such violation, the worker shall be terminated from employment at the Site.

Failure of the Contractor's supervisory personnel to implement this warning/termination provision shall be deemed a material breach of the Contract.

The Contractor shall provide, as a minimum, the following:

1. suitable containers for storage and disposal of used disposable PPE;
2. potable water and a suitable sanitation facility; and
3. shower and locker facility for all on-Site personnel.

The Contractor shall enforce the following provisions:

1. on-Site personnel shall wear appropriate PPE at all times when entering or working in the Exclusion Zone or Contaminant Reduction Zone;
2. used disposable PPE shall not be reused, and when removed, shall be placed inside appropriate containers provided for that purpose;
3. smoking, chewing nicotine products, eating and drinking shall be prohibited except in a designated lunch or break area;
4. soiled disposable outerwear shall be removed prior to entering the lunch area, and prior to cleansing hands;
5. on-Site personnel shall thoroughly cleanse their hands and other exposed areas before entering the smoking or lunch area;

6. all personnel working in the potentially contaminated work areas and/or Contaminant Reduction Zone shall shower and change to fresh clothing after each working period or shift, prior to leaving the Site;
7. used work clothing shall be laundered daily in a facility provided by the Contractor, at a location specified by the Engineer; and
8. water generated from washing and showering shall be stored in the designated wastewater storage tank in accordance with Section 01500.

Discarded disposable outerwear, gloves, and outer footwear shall be placed in sealable containers. Prior to placement, all discarded articles of clothing shall be segregated and secured in plastic bags. Articles which are soiled, stained, or have been in contact with contaminated materials shall be placed in separate Contractor supplied sealable containers. The remaining clean articles of clothing shall be placed in Contractor-supplied general refuse containers.

#### H. EMERGENCY AND FIRST AID EQUIPMENT AND SUPPLY

First aid equipment emergency first aid facility shall be located and maintained in appropriate locations as directed by the Health and Safety Officer. This equipment shall be stored on a portable pallet in order that it may be easily transported within the active work location. The required equipment shall include, at a minimum:

1. first-aid kit to accommodate on-Site personnel;
2. portable emergency eye wash and shower;
3. two 20-pound ABC type dry chemical fire extinguishers;
4. two self-contained breathing apparatus units (if confined space entry is to occur);
5. blankets and towels;
6. stretcher; and
7. one hand-held emergency siren.

As a minimum, the Contractor shall have one certified first aid technician on the Site at all times that work activities are in progress. This person may perform other duties but must be immediately available to render first aid when needed.

#### I. SITE COMMUNICATIONS

Emergency numbers shall be posted near Site telephones in accordance with the on-Site and off-Site Contingency and Emergency Response Plans.

Additionally, personnel shall work under the use of a "buddy" system and shall develop a hand signal system appropriate for Site activities.

An employee alarm system shall be provided to notify employees of on-Site emergency situations or to stop work activities if necessary.

Selected personnel shall be provided with two-way radios in accordance with Section 01500.

J. SAFETY MEETINGS

The Health and Safety Officer shall routinely conduct safety meetings as required which shall be mandatory for all Site personnel. The meetings shall provide refresher training for existing equipment and protocols, review ongoing safety issues and protocols and shall examine new Site conditions as they are encountered. Additional safety meetings shall be held on an as-needed basis.

K. CUSTODIAN

The Contractor shall employ and provide a custodian who shall be responsible for keeping all safety equipment and project facilities clean, properly equipped and maintained. The custodian may perform other duties for the Contractor but the custodian's first priority will be maintenance of protective equipment and the decontamination area. The custodian shall report directly to the Health and Safety Officer.

4. AIR MONITORING

A. AIR MONITORING PROGRAM

During the progress of work activities, the Contractor shall monitor air quality in and around the Exclusion Zone and Site perimeter. Monitoring shall be conducted on a regular periodic basis, and additionally as required by special or work-related conditions. Any departures from general background shall be reported to the Engineer who will, in conjunction with the Health and Safety Officer, determine when operations should be shut down and restarted.

The Contractor shall provide the required instruments for air monitoring including, as a minimum, an organic vapor photoionizer or organic vapor analyzer and if confined space work is to occur, an oxygen level meter and an explosimeter. Additionally, personnel sampling pumps and dust monitors may be required if Site conditions warrant. The Contractor shall provide sufficient numbers of each instrument to monitor the active work location and to provide backup equipment in cases of equipment malfunction.

Contractor air monitoring equipment shall be operated by Contractor personnel trained in the use of the specific equipment provided and shall be under the control of the Health and Safety Officer. All monitoring equipment used within the potentially contaminated work areas with combustible gases shall be intrinsically safe.

Air monitoring for organic vapors, shall be conducted on a routine basis around all active work locations. Monitoring shall be performed as a minimum on an hourly basis and additionally as dictated by Site activities.

Should the organic vapor level in any active working location exceed 50 ppm for any single reading, or 25 ppm for any two successive readings, or should the explosimeter indicate in excess of 10 percent of the Lower Explosive Limit (LEL) on any single reading,

or reduced oxygen concentrations less than 19.5 percent oxygen, or if toxic gases and particulates are present in concentrations which present Immediate Danger to Life and Health (IDLH) or in excess of the protection factor afforded by the air purifying respirator (whichever is lower), then that work location shall be shut down and evacuated upwind. Work shall not resume at that work location until authorized by the Health and Safety Officer.

A wind direction indicator shall be provided and installed by the Contractor at each active work location.

**B. AIR MONITORING REPORTING**

The results of air monitoring programs shall be reported by the Contractor to the Engineer daily on specific forms and shall include the following information as applicable:

1. Site location/date;
2. work process/operation name;
3. temperature, wind speed and wind direction;
4. area sampling location diagram;
5. field notes including the following:
  1. description of operations and complaints/symptoms,
  2. chemicals/materials/equipment in use,
  3. engineering/administration controls in effect,
  4. personal protective equipment in use, and
  5. sampling observations/comments.

In addition, all daily air monitoring activities shall be recorded in a hard cover log book which shall be maintained on the Site at all times by the Health and Safety Officer.

**5. CONTINGENCY AND EMERGENCY RESPONSE PLANS**

**A. GENERAL**

Prior to mobilization to the Site the Contractor shall be required to prepare both on-Site and off-Site Contingency and Emergency Response Plans to ensure the safety of on-Site and off-Site personnel. The Contractor's on-Site and off-Site Contingency and Emergency Response Plans shall be incorporated into the Contractor's Site-specific Health and Safety Plan.

**B. ON-SITE CONTINGENCY AND EMERGENCY RESPONSE PLAN**

The Contractor's on-Site Contingency and Emergency Response Plan shall address the standard operating procedures to be implemented during emergency situations. Emergency situations and responses to be addressed shall include, as a minimum, the following:

1. In the event of injury to on-Site personnel or contact with hazardous materials requiring immediate medical attention, the following protocol shall be followed:
  1. notify the Engineer and the Health and Safety Officer,



2. phone the hospital previously identified to be closest to the Site and describe injury,
  3. decontaminate personnel and administer appropriate first aid, and
  4. transport personnel to the specified hospital along the most direct route which will be predefined prior to commencing Site work;
2. In the event that barrels or canisters are encountered during excavation, all work shall immediately cease and the Health and Safety Officer in conjunction with the Engineer shall determine appropriate modifications to the Site-specific Health and Safety Plan.
  3. In the event that excessive gases or vapors are detected at an excavation, the following actions shall be taken:
    1. evacuate all workers to an area upwind from the effected area; and
    2. identify the contaminant and monitor contaminant concentrations to determine the type of respiratory protection and/or engineering controls required before workers re-enter the area;
  4. In the event of a fire at an excavation, earth moving equipment shall be used to quickly backfill the area and smother the fire if possible and if the presence of noxious gases prohibits this, proper evacuation procedures shall be employed; and
  5. In the highly unlikely event of a major leak of toxic gas, such as might occur if a compressed gas cylinder were encountered and ruptured during excavation, all on-Site personnel shall be evacuated to a safe distance, and the Police and Fire Department and local hospital notified if deemed necessary by the Engineer and the Health and Safety Officer. Police and Fire Department Officials will assume responsibility for coordinating with the Engineer and the Health and Safety Officer for the proper emergency response strategy upon arrival.

C. OFF-SITE CONTINGENCY AND EMERGENCY RESPONSE PLAN

Prior to commencing work involving the handling of hazardous materials, the Contractor shall develop an off-Site Contingency and Emergency Response Plan. This plan is intended to provide immediate response to a serious Site occurrence such as explosion, fire or migration of significant quantities of toxic or hazardous material from the Site which could affect or endanger the public or adjacent public or private areas.

The Engineer shall be responsible for coordination of meetings with local officials, issuing minutes of meeting and preparation of the off-Site contingency and emergency response plan for distribution.

The Contractor shall attend a coordination meeting to be held with appropriate authorities which may include the City, Fire, Hospital, State and City Police, State Department of Transportation, the County Health Department and Civil Defense officials. The meeting shall identify the off-Site Emergency Response Coordinator through whom all information and coordination will occur in the event of an incident. Plans and procedures shall be developed, or existing plans and procedures adopted, for:

1. evacuation of Site adjacent areas;
2. fire fighting procedures;
3. transport of injured personnel to medical facilities;
4. priority transportation routes; and
5. coordination and/or modification of highway operations.

Techniques and recommended procedure for immediate first aid emergency response shall be developed by the Health and Safety Officer with local medical facilities.

6. **SITE HEALTH AND SAFETY**

A. **WORK AREAS**

The Contractor shall clearly lay out and identify work areas in the field and shall limit equipment, operations and personnel in the areas as defined below. These work areas may be established as temporary or permanent, depending on the work activity and the sequence in which it is performed. These areas are:

1. the Exclusion Zone which includes all areas where hazardous or potentially contaminated (soils, debris and other materials) are being, or may be contacted, disturbed or handled and all areas where contaminated equipment or personnel travel; Temporary Exclusion Zones shall be established around all remote work areas beyond the limits of the Exclusion Zone located within the Site fence and shall be clearly delineated in the field by temporary snow fencing and/or barricades supplied and installed by the Contractor;
2. the Contaminant Reduction Zone which shall occur at the interface of the Exclusion Zone and Clean Zone and shall provide for the prevailing upwind transfer of construction materials from clean to Site-dedicated equipment, the decontamination of equipment and vehicles prior to entering the Clean Zone, the decontamination of personnel and clothing prior to entering the Clean Zone, and for the physical segregation of the Clean and Exclusion Zones;
3. the Clean Zone which is defined as a clearly delineated predominantly upwind area outside the Exclusion Zone(s) and Contaminant Reduction Zone(s), which functions include:
  1. an entry area for personnel, material and equipment to the Contaminant Reduction Zone;
  2. an exit area for decontaminated personnel, materials and equipment from the Contaminant Reduction Zone; and
  3. a storage area for clean safety and work equipment.

B. **TEMPORARY FENCING**

The Contractor shall erect temporary fencing on the Site to delineate work areas in accordance with the Site-specific Health and Safety Plan.

Temporary fencing shall be constructed of standard snow fence or construction fence supported by posts.

The Contractor shall coordinate the erection of temporary fencing with the work specified under other Sections of the Project Specifications. Prior to or during mobilization, the Contractor shall erect fencing to enclose the Exclusion Zone.

The Contractor may reuse existing temporary fencing. Temporary fencing to be reused or reset at another location shall first be decontaminated to the satisfaction of the Engineer.

C. CONTAMINANT MIGRATION CONTROL

The Contractor shall take appropriate measures to prevent the tracking of contaminants on and off the Site. Vehicles, equipment, and personnel leaving areas of potential contamination shall be decontaminated as determined by the Health and Safety Officer prior to entry into Clean Zones. The Contractor shall locate decontamination facilities and sequence work activities to prevent contaminant tracking.

Personnel engaged in vehicle decontamination shall wear protective equipment including suitable disposable clothing, respiratory protection and face shields.

D. DRUM HANDLING PROGRAM

Drums used during cleanup activities shall meet appropriate DOT, OSHA, USEPA and State regulations for the wastes that they contain. Drums shall be labelled as to content and date filled.

Site operations shall be coordinated so as to minimize the amount of drum or container movement. Drums shall be inspected prior to shipment and shall be staged so as to facilitate inspection.

Appropriate salvage drums shall be kept available and used in areas where spills or leaks may occur. A spill containment program shall be implemented to contain and isolate any and all of the hazardous substances being transferred.

Prior to commencing work involving handling of drums and other containers, the Contractor shall submit to the Engineer procedures for safe handling of drums and other containers in accordance with OSHA 29 CFR 1910.120 (j). During any activities involving drummed waste characterization including but not limited to handling, opening, sampling, staging and consolidating, the Health and Safety Officer shall be responsible for and shall ensure that the drum handling program is implemented and enforced.

E. CONFINED SPACE ENTRY PROGRAM

(1) Responsibility

The Health and Safety Officer shall be responsible to ensure that minimum precautions as specified herein have been taken to assure safe entry of confined spaces, as stated in 29CFR 1910.146.

(2) Procedure

(a) Time Period Covered by Permits

Site personnel shall not enter any confined space without a written confined space work permit (see Appendix A for sample permit).

The confined space work permit will be valid for a single shift only. On jobs requiring more than a single shift to bring to completion, a new permit shall be completed at the start of each shift.

(b) Variances

1. Inability to Follow Procedure

Should any circumstances be found where these rules cannot be met, rules to insure adequate safety for entering these specific confined spaces must be written out by the Health and Safety Officer, for approval in accordance with the Health and Safety Plan. This variance shall detail any special conditions and shall be attached to the confined space work permit.

(c) Availability of Permit

Properly completed permits must be readily available at the Site. They must be kept on file indefinitely after the completion of the shift for which they were issued.

(d) Preparation of Equipment For Safety

Power must be de-energized, locked and tagged.

Every effort must be made to remove all hazardous contents from the confined space. Tests for flammable vapor and oxygen content must be taken on a continuous basis while anyone is in the confined space. If the tests do not meet the requirements of items (e)1. and (e)2, the workers must leave the confined space.

(e) Testing of Atmospheres Within Confined Spaces

1. Oxygen

Oxygen content must be above 19.5 percent and below 23.5 percent before entry will be allowed.

2. Flammable Vapors

Personnel shall leave confined spaces if the concentration of explosive gases exceeds 10 percent of the lower explosive limit (LEL). If hot work is to be conducted in the space, then explosive gasses cannot exceed 0% (LEL).

(f) Ingress and Egress

A safe means of ingress and egress, such as a portable ladder, must be kept in place at all times when personnel are occupying a confined space.

(g) Protective Clothing

Modified Level C protection shall be worn as a minimum by personnel entering confined spaces where the confined space has been made vapor free, meaning the vapor concentration is below the Threshold Limit Value (TLV) of the vapor being monitored, the total organic vapor readings are less than 5 ppm, the LEL is zero and the oxygen content is between 19.5 and 23.5 percent, and continuous air monitoring with a photoionization detector, oxygen meter and explosimeter is maintained. If all these conditions are not met, Level B protection shall be worn. The Site-specific Health and Safety Plan shall include a full confined space entry program.

(h) Life Lines

Means shall be provided for quick removal of individuals from confined spaces in emergencies. Where the least dimension of the access opening is less than 24 inches, wrist straps or noose-type wristlets shall be worn. Where the least dimension of the access opening is greater than 24 inches, either a life belt, safety harness, wrist straps or noose-type wristlets may be worn. In either case, a life line shall be attached and securely anchored outside the confined space.

(i) Illumination

Temporary lighting used in the confined space shall be of the explosion proof design with heavy duty cords and fittings and insulations maintained in good condition.

Portable (battery powered) lighting shall be operated at a maximum of 12 volts.

Portable (battery powered) lighting shall be kept at-the-ready outside of the confined space access opening to be used as illumination in the event of failure of the principle system. These lights shall be capable of providing illumination for a period of at least one hour.

(j) Safety Monitors

A person designated as a safety monitor shall be stationed at the access opening of any confined space while it is occupied. He/she must have continuous visual or verbal contact with occupants. One of his/her major responsibilities is to summon additional help in emergency situations.

In addition to the safety monitor, there shall be another person located within 100 feet of the confined space opening. This individual may do work other than that related to the confined space entry but it should not be such as to prevent his/her responding to a call for aid.

(k) Equipment Immediately Available to the Safety Monitor

The following emergency items shall be located at the access opening of the confined space or not more than 15 feet from such opening:

1. respiratory equipment as specified for Level B protection;
2. life lines, as described in item h above;
3. a battery powered portable light, as described in item (i) above; and
4. a portable type air-horn, capable of being heard 100 feet away over background noises.

7. MEASUREMENT AND PAYMENT

A. DEVELOPMENT, IMPLEMENTATION AND MAINTENANCE OF SITE-SPECIFIC HEALTH AND SAFETY PLAN

Payment for the development, implementation and maintenance of the Site-specific Health and Safety Plan will be made at the lump sum price stipulated in the Schedule of Prices for Item B-1 which price and payment shall be full compensation for the development and preparation of a Site-specific Health and Safety Plan; provision of all required training; provision of emergency first aid facilities; designation and maintenance of work areas; air monitoring; provision of a Personnel Hygiene/Decontamination Facility and Emergency First Aid Facility; provision of specified services; maintaining, cleaning and stocking the Personnel Hygiene/Decontamination Facility, the Emergency First Aid Facility, the toilet facilities, the Contractor's and Engineer's Office, and all other miscellaneous items for which separate payment is not provided under other Items.

As the Contractors selected to bid on this particular job are considered to be involved in hazardous waste activities on a full-time basis, the Contractor shall provide personnel who have already complied with the medical requirements as specified herein. Medicals for Contractor personnel shall not be included as a pay item. Additional medical surveillance required during the progress of the Works due to excessive exposure to toxic chemicals or physical agents shall be considered as an extra.

B. PROVISION OF HEALTH AND SAFETY AND PERSONAL PROTECTIVE EQUIPMENT - LEVEL C

(1) Measurement

Measurement for provision of health and safety and personal protective equipment - Level C will be made in mandays for the actual number of days worked per man wearing the specified protective equipment as determined by the Engineer from daily time sheets provided by the Contractor and submitted to the Engineer on a daily basis for approval.

(2) Payment

Payment for the quantity determined above will be made at the unit price per manday stipulated in the Schedule of Prices for Item B-2 which price and payment shall be full compensation for providing and maintaining personal protective

equipment for Level C for all Contractor personnel; and all other miscellaneous items for which separate payment is not provided under other Items.

C. PROVISION OF HEALTH AND SAFETY OFFICER

(1) Measurement

Measurement for provision of a Health and Safety Officer will be made at the actual number of days that the Health and Safety Officer works on Site, as determined by the Engineer from daily time sheets provided by the Contractor and submitted to the Engineer on a daily basis for approval.

(2) Payment

Payment for the quantity determined above will be made at the unit price per day stipulated in the Schedule of Prices for Item B-3 which price and payment shall be full compensation for providing a qualified Site Health and Safety Officer including salary, wages, taxes and benefits; and all other miscellaneous items for which separate payment is not provided under other items.

D. PROVISION OF CUSTODIAN

(1) Measurement

Measurement for provision of a Custodian will be made at the actual number of days that the Custodian works on Site, as determined by the Engineer from daily time sheets provided by the Contractor and submitted to the Engineer on a daily basis for approval.

(2) Payment

Payment for the quantity determined above will be made at the unit price per day stipulated in the Schedule of Prices for Item B-4 which price and payment shall be full compensation for providing a custodian including salary, wages, taxes and benefits; and all other miscellaneous items for which separate payment is not provided under other items.

END OF SECTION

## SECTION 01300 - SUBMITTALS

### 1. GENERAL

Unless otherwise specified, drawings, product data and other technical information specified to be submitted by the Contractor to the Engineer shall be submitted in triplicate, consisting of one original and two copies. Copies shall be legible and shall clearly show all information contained on the original. Where Section 01300 or other requirements of the Project Specifications specify that submittals shall be prepared and sealed by a professional engineer, such professional engineer shall be licensed in the State of Ohio.

Where submittals are to be reviewed and approved by the USEPA and/or OEPA, final approval of such submittals and the schedule of any work upon which such approval is dependent are subject to review times of the USEPA.

### 2. CONTRACTOR'S CONSTRUCTION SCHEDULE

Within seven (7) calendar days of the date of Notice of Award and prior to commencing the Works at the Site, the Contractor shall submit a detailed construction schedule to the Engineer for review and approval. The Contractor's construction schedule shall show all activities required for construction of the Works in accordance with the construction schedule issued by the Engineer and identified in Section 01010 of the Project Specifications.

The schedule shall clearly show the proposed sequencing of the Works and the coordination of interrelated work activities and items. The proposed progress of the Works shall be shown on a weekly basis. The schedule shall, as a minimum, include each item of work identified in the Schedule of Prices as a work activity and identify the proposed start and completion date for each activity. The schedule shall be of sufficient detail to permit cross-referencing of items identified in other submittals. As a minimum, the schedule shall identify on a weekly basis: the size of the work force, anticipated man hours by trade, the type of equipment, the equipment hours for each type of equipment and demobilization. Actual progress of each activity of the Works shall be compared with progress indicated on the Contractor's Construction Schedule no less than once every month by the Contractor and such comparison shall be submitted to the Engineer for review.

If the Contractor believes it necessary or advantageous to change sequence of activities shown on the approved Contractor's construction schedule, he shall submit proposed revisions to the Engineer for approval. No change shall be made in order in which work activities are being performed until the Engineer's written approval for the revised schedule has been obtained.

### 3. CONSTRUCTION PROGRESS REPORTS

The Contractor shall submit weekly progress reports in a form acceptable to the Engineer indicating actual progress made the preceding week, showing cumulative progress toward scheduled completion, expressed as a percentage, of all items in the Contractor's construction schedule, number of workers and hours worked on the Site for each trade and the number and type of equipment and hours worked on the Site during the previous week. An updated schedule showing work tasks completed, any projected difficulties which may delay or alter the schedule and any modifications to the original schedule shall be included with the weekly progress report.



4. CONSTRUCTION QUALITY CONTROL LOGS

The Contractor shall record his daily quality control activities on a "Daily Construction Quality Control Report". All Site activities, Site inspections, submittals made by material suppliers and field testing of materials shall be recorded along with any unacceptable Site occurrences on a daily basis. The Daily Construction Quality Control Report shall be signed and reviewed by the Contractor and the Engineer at the completion of each work day. Attachment D presents an example of a typical Daily Construction Quality Control Report. The Contractor may use alternative forms providing the same information subject to the prior approval of the Engineer.

5. CONTRACTOR'S DRAWINGS

If specified, detailed drawings of material and structures to be supplied by the Contractor shall be prepared from typical details shown on "Approved for Construction" drawings and/or from specified requirements. Contractor's drawings shall be submitted to the Engineer for review and will be returned to the Contractor stamped and noted as being "Reviewed" by the Engineer before fabrication or construction commences.

All submittals shall bear the Contractor's approval stamp prior to their initial submission to the Engineer and shall be signed, dated and identified as to the specific project.

Dimensions shown on the Contractor's drawings shall conform with actual measurements of existing and/or completed associated structures and affected adjacent work.

Contractor's drawings shall indicate materials, methods of construction attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Works. Where articles or equipment attach or connect to other articles or equipment, the Contractor shall indicate that such work has been coordinated, regardless of the Project Specification Section under which the adjacent items will be supplied and installed. Contractor's drawings shall be cross-referenced to appropriate Project Specifications and Drawings.

The Contractor shall make changes in Contractor's drawings as the Engineer may require, consistent with the Contract Documents. When resubmitting drawings the Contractor shall notify the Engineer in writing of any revisions other than those requested.

Adjustments made on the Contractor's drawings by the Engineer are not intended to change the Contract Price. If adjustments affect the value of the Works, the Contractor shall state such in writing, as specified elsewhere in the Contract, to the Engineer prior to proceeding with the Works.

The Contractor shall submit three legible copies of drawings for each requirement requested in the Project Specifications and as the Engineer may reasonably request.

One print of each drawing will be returned stamped and noted as "Reviewed" by the Engineer, or marked up to show the Engineer's required modifications and noted as "Revise and Re-Submit". The Contractor shall correct and resubmit drawings as often as necessary until the Engineer returns drawings without marked modifications and stamped "Reviewed".

The Contractor shall not be relieved of any part of his responsibilities for correctness of his drawings or adequacy of his design bearing the Engineer's "Reviewed" stamp. The Engineer's

review is for the sole purpose of ascertaining conformance with general design concepts, and in no way constitutes approval of the detail design inherent in the Contractor's drawings, responsibility for which remains with the Contractor.

6. MANUFACTURER'S PRODUCT DATA

Where specified or as requested by the Engineer, the Contractor shall submit to the Engineer duplicate copies of product data sheets or brochures for requirements requested in the Project Specifications and as the Engineer may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

The Contractor shall also submit to the Engineer prior to a materials arrival on Site, Material Safety Data Sheet for all materials brought to the Site requiring special handling procedures.

7. OPERATING AND MAINTENANCE MANUALS

Where specified, the Contractor shall submit to the Engineer six (6) copies of operating and maintenance manuals. Operating and maintenance manuals shall be submitted and approved by the Engineer prior to Final Acceptance of the Works.

Operating and maintenance manuals shall contain operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and relevant maintenance information. Instructions in this manual shall be in simple language so as to guide the operator in the proper operation and maintenance of components.

The operating and maintenance manuals shall be bound in a three-ring hard covered binder approved by the Engineer.

In addition to information specified, the operating and maintenance manuals shall include the following information:

1. Title Sheet, labeled "Operating and Maintenance Instructions", containing project name and date;
2. list of names, addresses and telephone numbers of subcontractors and suppliers who can effect repair or maintenance on equipment supplied by the Contractor;
3. list of contents;
4. final shop drawings and product data of equipment;
5. Record Drawings of mechanical and electrical installation;
6. full description of system(s) and operation; and
7. other requirements as may be described in further detail in the Project Specifications.

8. RECORD DRAWINGS

After award of Contract, the Engineer will provide an extra set of Drawings to the Contractor for the purpose of maintaining record drawings during performance of the Works.

The Contractor shall accurately and neatly record deviations from the Contract Documents caused by Site conditions and changes ordered by the Engineer, on the extra set of Drawings.

Locations of concealed components of mechanical and electrical services also shall be recorded on the extra set of Drawings.

Such drawings shall be identified as "Record Drawings" and shall be maintained in new condition and made available for inspection on the Site, as required by the Engineer.

On completion of the Works and prior to final inspection, the Contractor shall submit record drawings and documents to the Engineer.

9. SUBMITTALS FOR WEEKLY MEETINGS

The following are minimum required submittals to be provided to the Engineer at least 24 hours prior to scheduled weekly meetings:

1. updated job progress schedules detailing all activities. Include review of progress with respect to previously established milestones and schedules, major problems and action taken, injury reports, equipment breakdown and all bulk material removal and all air sampling results conducted by the Contractor;
2. copies of all transport manifests, trip tickets and disposal receipts for all waste materials removed from the work area during the Works;
3. weekly copies of work-site entry logbooks with information on worker and visitor access.
4. weekly logs documenting filter changes on HEPA vacuums, and other engineering controls; and
5. weekly results of air sampling data collected during the course of the Works, including OSHA compliance air monitoring results.

10. MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for work under Section 01300.

END OF SECTION

## SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

### 1. SITE OFFICES

During the performance of the Work, the Contractor shall provide and maintain separate and suitable offices at the Site for the Contractor, the Engineer and the Agencies.

The Engineer's and Agencies' offices shall have a minimum floor space of 600 square feet and 300 square feet, respectively, and include a lockable storage closet (and storage area), toilet and hand washbasin, including connection to potable water supply and piping to Contractor-supplied wastewater holding tanks. The offices shall be provided with adequate fluorescent lighting. Heating and cooling facilities shall be provided to maintain an ambient temperature of 68°F to 72°F.

The Engineer's and Agencies' offices shall each be equipped with two lockable four-drawer filing cabinets, two office desks, six office chairs and one plan/reference table. The offices shall be lockable. Locks will be provided by the Engineer.

The offices shall be located at the Site as shown on the Drawings or as directed by the Engineer.

### 2. PERSONNEL HYGIENE/DECONTAMINATION FACILITY

The Contractor shall provide, operate, and maintain a personnel hygiene/decontamination facility which complies with the requirements of 29 CFR 1910.141. The facility shall contain, as a minimum, the following:

1. shower facilities with at least one shower for every six (6) on-Site Contractor personnel;
2. locker room with one locker for each on-Site Contractor personnel plus three (3) additional lockers for use by the Engineer and regulatory agencies;
3. toilet facilities with at least one toilet and one hand basin for every six (6) on-Site Contractor personnel;
4. an on-Site room where personnel can eat, drink or smoke;
5. a room where all personnel safety equipment and protective clothing can be stored;
6. boot washing facility and boot rack for washed boots to drain; and
7. sanitary waste and wash water holding tanks and necessary pumping and piping from the Personnel Hygiene/Decontamination Facility to the wastewater tanks.

The Contractor shall connect the necessary pumping and piping to convey wastewaters from the shower facilities, boot washing facility, and hand basin to the designated wastewater storage tanks.

The Contractor shall sample and analyze containerized wastewater for disposal purposes. The analytical results shall be provided to the Engineer. The Engineer will determine if the wastewaters can be treated at the on-Site groundwater treatment facility or if they must be disposed of off Site.

The Contractor shall supply, install and connect separate holding tanks for the sanitary waste from the toilet facilities. The Contractor shall remove the contents of the sanitary waste holding tanks and discharge the wastes to a municipal sewerage system on a periodic basis as required and in accordance with governing regulations of authorities having jurisdiction.

The Contractor shall provide sufficient sanitary facilities for workers in accordance with governing regulations and ordinances.

The Contractor shall post notices and take such precautions as required by local health authorities.

The Contractor shall maintain the personal hygiene/decontamination facility and premises in a clean and sanitary condition and on completion of the Works shall remove the facilities and disinfect the premises.

3. **EQUIPMENT DECONTAMINATION FACILITY**

The Contractor shall construct an equipment/vehicle decontamination facility as shown on the Drawings. The Contractor shall provide pumps and housing as required to remove decontamination wastewater to separate tankage provided by the Contractor.

The equipment decontamination facility constructed by the Contractor will be a permanent installation and will be used by other contractors during remedial construction activities at the Site.

Equipment decontamination shall take place on the equipment decontamination facility and shall consist of degreasing, if required, followed by high pressure, low-volume, hot water or steam supplemented by detergents as appropriate.

Special attention shall be paid to removal of material on and within the tracks and sprockets of crawler equipment, and the tires and axles of trucks and rubber tire mounted equipment. The Contractor shall take measures to minimize the drift of mist and spray during decontamination. Such measures shall include the use of wind screens.

The decontamination wash unit shall be portable, high pressure with self-contained water storage tankage and pressurizing system. The unit shall be capable of heating and maintaining wash waters to 180°F and providing a nozzle pressure of 150 psi.

All decontamination waters shall be collected and transferred to the appropriate wastewater storage tank. Sediment accumulating in the decontamination sump shall periodically be collected and placed in the existing on-Site soil/sediment stockpile as directed by the Engineer. The Contractor shall supply and operate all equipment required to collect, contain and transfer decontamination wastewaters and sediments. All decontamination waters shall be treated at the Trust on-Site groundwater treatment facility after commissioning of the treatment facility by the Contractor. The Contractor may utilize existing on-Site wastewater tanks. Any additional wastewater tanks required for performance of the Works shall be provided by the Contractor.

4. **EMERGENCY FIRST AID FACILITY**

The Contractor shall provide, operate and maintain an emergency first aid facility which complies with the requirements of 29 CFR 1910.141. This facility may be housed within or adjacent to the Personnel Hygiene/Decontamination Facility. The Emergency First Aid Facility shall have available, as a minimum, the following equipment and supplies:

1. stretcher;
2. one set of crutches;
3. two fire extinguishers meeting the requirements of 29 CFR 1910.307;
4. two self contained breathing apparatus units including full face masks;
5. one counter and sink with running potable water connected to the sanitary wastewater holding tanks;
6. one cot;
7. blankets and towels as required;
8. first aid kit containing medications appropriate for the initial treatment of burns, abrasions, fractures, and ingestion or dermal contact with on-Site hazardous waste;
9. one hand-held area siren/alarm;
10. two complete sets of enhanced USEPA Level B personal protective equipment; and
11. portable emergency eye wash and shower.

The Contractor shall keep at the Site at all times a sufficient number of fully equipped first aid kits for availability at each work location and shall post emergency and ambulance phone numbers in large letters beside each Site telephone.

5. **PORTABLE TOILETS**

The Contractor shall provide a minimum of two (2) portable sanitary toilets. The Contractor shall remove and dispose of sanitary wastes off Site on a periodic basis as required and in accordance with applicable laws and regulations. In lieu of portable sanitary toilets, the Contractor may provide toilets housed within the personnel hygiene/decontamination facility which are connected to separate collection tanks.

6. **PARKING**

Should off-road parking be required, the Contractor shall supply parking areas at its own expense.

The Contractor shall locate parking in a designated on-Site clean zone as shown on the drawings such that parked vehicles do not interfere with Site operations and/or adjacent facilities. The Contractor shall provide two parking spaces for the use of the Engineer.

7. ACCESS ROADS

The Contractor will be permitted reasonable use of all existing access roads at the Site subject to the following conditions:

1. traffic on roads or parking areas shall not be interrupted or interfered with at any time except where open-trench crossings have been specified on the Drawings and proper notice regarding open-trench crossings has been given to the Engineer; and
2. all vehicles comply with weight and load size restrictions where applicable.

Maintenance of access roads during performance of the Works shall include provision of all signs, barricades, gatepersons, flagpersons, flares and lights and other measures required. The Contractor shall provide flag persons for all construction traffic crossing or entering local traffic routes or otherwise required on the Site.

The Contractor shall take appropriate measures to prevent contamination of access roads and other clean areas during performance of the Works. Debris or material on access roads which is suspected to be contaminated as determined by the Engineer shall be scraped up, transported and placed by the Contractor into a designated area as directed by the Engineer. The Contractor shall repair any wear and tear and damage to access roads arising out of the Contractor's construction operations.

8. TELEPHONE AND FACSIMILE

The Contractor shall provide and pay for separate telephone service at the Site office for use by the Engineer, Agencies and Contractor. The Engineer's telephone service shall include two telephone lines and one facsimile line. A radio telephone service will not be acceptable. The Agencies telephone service shall include one telephone line.

The Contractor shall not be responsible for long distance charges incurred by the Engineer or the Agencies but shall be responsible for the hook-up charge and monthly charge for the telephone service. Emergency numbers including police, fire, ambulance, hospital, poison control center and appropriate regulatory agencies shall be provided by the Contractor and prominently posted near each phone. The telephone service provided for the Engineer shall include two separate independent telephone lines.

The facsimile service for the Engineer shall include one plan paper facsimile machine capable of receiving and sending 8 1/2 x 11 inch and 8-1/2 x 14 inch sheets of plan paper. The facsimile machine shall be a Zerox 7024.

9. ELECTRICAL POWER AND SITE LIGHTING

The Contractor shall provide and pay for all power required for the performance of the Works, including provision of all necessary power distribution system and special connections to existing power system.

The Contractor shall supply, erect, operate and maintain adequate Site lighting to facilitate performance of the Works and to maintain a safe working condition. As a minimum, the Contractor shall provide outside area lighting in the office area and the decontamination area.

10. POTABLE WATER

The Contractor shall provide and pay for all necessary potable water, potable water holding tanks, distribution system and connections to a potable water supply. The Contractor shall maintain an adequate supply of potable water at the Site at all times.

11. TEMPORARY HEATING

The Contractor shall provide temporary heating, covering and enclosures as necessary to protect all work and material against damage by dampness, freezing and cold and to facilitate completion of the Works. The Contractor shall supply all fuel, equipment, materials and attendance required for temporary heating.

The Contractor shall be responsible for damage to the Works due to failure in providing adequate heat and protection during construction.

12. GUARDRAILS AND BARRICADES

The Contractor shall provide, erect and remove barricades and guardrails as required by laws and codes for the performance of the Works. Guardrails and barricades shall be erected in a timely manner around all excavations, open trenches and active work areas as shown on the Drawings and as directed by the Engineer. All excavations and work activity adjacent to Municipal, County or State roadways shall be guarded and barricaded to the standards and requirements of the respective Municipal, County or State maintenance authority as a minimum.

The Contractor shall ensure that all open excavations are flagged and barricaded prior to leaving the Site at the end of each work day.

13. DEWATERING

Except as specified otherwise, the Contractor shall dewater the various parts of the Works including, without limitation, excavations, structures, foundations and work areas.

The Contractor shall employ construction methods, plant, procedures and precautions that will ensure the Works, including excavations, are stable, free from disturbance and dry.

Construction methods may include but are not limited to: sheeting and shoring; groundwater control systems; surface or free water control systems employing ditches, diversions, drains, pipes and/or pumps; and any other measures necessary to enable the whole of the Works to be carried out in the dry. Before dewatering is started, the Contractor shall obtain acceptance by the Engineer for the method, installation and details of the dewatering system.

The Contractor shall provide sufficient and appropriate labor, plant and equipment necessary to keep the Works free of water including standby equipment necessary to ensure continuous operation of dewatering system.

The Contractor shall take precautions necessary to prevent uplift of any structure or pipeline and shall protect all excavations from flooding and damage due to surface runoff.



The Contractor shall control surface drainage including ensuring that gutters are kept open at all times, water is not directed across or over pavements or sidewalks except through approved pipes or properly constructed troughs and runoff from unstabilized areas is intercepted and diverted to a suitable outlet.

All surface water from potentially contaminated materials and groundwater shall be contained and transferred to the on-Site groundwater treatment system by the Contractor. The Contractor shall provide and operate suitable pumping equipment to pump excess water from the on-Site East pond to the on-Site groundwater treatment system at a controlled rate as directed by the Engineer to maintain the water level in the on-Site East pond below a specified level during performance of the Works.

14. SITE SECURITY

The Contractor shall provide Site security which as a minimum, shall include the following:

1. limit access to the Site to authorized vehicles and personnel only;
2. provide a list of authorized personnel and the name of their employer to the Engineer;
3. provide the Health and Safety Officer with radio communication to the Site office;
4. maintain a security log in which documentation is provided of all Contractor personnel, deliveries and any security incidents. This log shall include the date, name, address, company, time in and time out for each Contractor personnel. If unauthorized personnel are observed on the Site, the appropriate law enforcement officials shall be called upon for proper legal actions; and
5. check that the perimeter fencing and all warning signs are secure and intact on a daily basis. If deterioration of the Site security fence is observed, or if warning signs are found to be removed, the situation shall be brought to the attention of the Engineer and shall be immediately rectified by the Contractor.

In addition to the above, the Contractor shall provide temporary security fencing as shown on the Drawings or as required to maintain existing access restrictions to the Site. Temporary security fencing shall be supported by steel posts driven into the ground, to a depth sufficient to support the fence and minimum six (6) feet high. The post spacing and the fence mesh/fabric shall be suitable for the intended purpose. All Site access gates shall be locked at all times when there are no on-Site activities and shall be maintained in a closed position during active construction activities.

15. DUST AND PARTICULATE CONTROL

The Contractor shall supply and maintain dust control measures such as water misting systems as required to prevent generation of dust during performance of the Works. Water used for dust control shall be potable water, or treated water from the Trust's on-Site groundwater treatment facility, if available.

16. SOIL EROSION AND SEDIMENT CONTROL

The Contractor shall implement a soil erosion and sediment control plan as specified and as shown on the Drawings. All collected sediments shall be disposed of at one of the designated on-Site spoil areas as directed by the Engineer.

The Contractor shall maintain soil erosion and sediment control facilities during construction.

The Contractor shall stabilize the disturbed soils as quickly as practical. Stripping of vegetation, regrading or other development shall be done in such a way as to minimize erosion. The Contractor shall remove accumulated sediment resulting from construction activity from all adjoining surfaces, drainage systems and watercourses and repair any damage caused by soil erosion and sedimentation as directed by the Engineer.

17. WASTEWATER STORAGE FACILITIES

A. GENERAL

The Contractor shall provide, operate and maintain separate wastewater storage facilities to collect and store decontamination wastewaters and sanitary wastewaters. Wastewaters to be collected and stored in the wastewater storage tanks include wastewaters from the personnel and equipment decontamination facilities. Wastewater from toilets, handbasins, showers and laundry area shall be disposed of off Site as approved by the Engineer.

B. INSTALLATION

The Contractor shall install the facilities in the locations shown on the Drawings or as directed by the Engineer.

The Contractor shall connect all pumping, piping, miscellaneous items and necessary utilities as required for operation of the facilities. All tanks, valves, pumping, piping and miscellaneous items shall be protected from freezing.

C. OPERATION

The Contractor shall not operate the facilities until the Engineer has inspected the facility.

The Contractor shall operate the facilities and do all work necessary to collect wastewaters, including general maintenance and repairs when necessary.

The Contractor shall notify the Engineer 72 hours in advance of when a wastewater storage tank is anticipated to be full. The Contractor shall supply transportable tankage to remove stored liquids. The Contractor shall sample the liquids for disposal and have the sample analyzed to determine the final disposition of the wastewaters. Analytical results shall be submitted to the Engineer. The Contractor shall not discharge additional liquids to a filled tank following sampling by the Contractor. The Contractor shall transport and dispose of wastewaters at a facility as identified by the Contractor and approved by the Engineer.

18. PROTECTION OF MONITORING WELLS AND PIEZOMETERS

Monitoring wells and piezometers are located in the working area. The Contractor shall protect monitoring wells and piezometers and shall take all necessary precautions to avoid damage to these monitoring wells and piezometers. Any monitoring well or piezometer damaged by the Contractor during performance of the Works shall be repaired or replaced by the Contractor, as directed by the Engineer, at no additional cost to the Trust.

19. PHOTOCOPY MACHINE

The Contractor shall provide and pay for a separate photocopier machine capable of photocopying 8 1/2 x 11 inch and 11 x 17 inch sheets of paper. The Contractor shall not be responsible for providing the paper for the copy machine but shall be responsible for all rental and maintenance charges. The photocopier machine shall be a Xerox 5028.

20. MEASUREMENT AND PAYMENT

A. SITE OFFICES

Payment for Site offices will be made at the lump sum price stipulated in the Schedule of Prices for Item C-1 which price and payment shall be full compensation for supply of all labor, plant, material and equipment required to supply, install and maintain the Contractor's, Agencies and Engineer's Site offices and lunch room area, furniture, filing cabinets, plan tables, telephone, facsimile and photocopying services; and all other miscellaneous items for which separate payment is not provided under other Items.

B. PERSONNEL HYGIENE/DECONTAMINATION FACILITIES

Payment for personnel hygiene/decontamination facilities will be made at the lump sum price stipulated in the Schedule of Prices for Item C-2 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required to supply, install, maintain, clean and stock personnel hygiene/decontamination facility, emergency first aid facility, and toilet facilities; personnel hygiene and decontamination materials; toilets; wastewater and potable water holding tanks; and all other miscellaneous items for which separate payment is not provided under other Items.

C. SITE SECURITY

(1) Measurement

Measurement for Site security will be made in days for the actual number of days Site security is supplied by the Contractor as measured by the Engineer and calculated from daily time sheets submitted by the Contractor.

(2) Payment

Payment for the quantity determined above will be made at the unit price per day stipulated in the Schedule of Prices for Item C-3 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment

required for provision of 24 hour Site security; supply and maintenance of security office and equipment at the entrance gate; and all other miscellaneous items for which separate payment is not provided under other Items.

D. SOIL EROSION AND SEDIMENT CONTROL

Payment for soil erosion and sediment control facilities will be made at the lump sum price stipulated in the Schedule of Prices for Item C-4 which price and payment shall be full compensation for supplying, constructing, maintaining and removing soil erosion and sediment control facilities; and all other miscellaneous items for which separate payment is not provided under other Items.

E. EQUIPMENT/VEHICLE DECONTAMINATION FACILITY

Payment for the construction and maintenance of the equipment/vehicle decontamination facility will be made at the lump sum price stipulated in the Schedule of Prices for Item C-5 which price and payment shall be full compensation for the supply, installation and maintenance of the facility including materials; and all other miscellaneous items for which payment is not provided under other Items.

F. PROTECTION OF MONITORING WELLS AND PIEZOMETERS

Payment for protection of monitoring wells and piezometers will be made at the lump sum price stipulated in the Schedule of Prices for Item C-6 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for protection of monitoring wells and piezometers; and all other miscellaneous items for which separate payment is not provided under other Items.

No separate measurements and payment will be made for other construction facilities and temporary controls required for implementation of the Works.

END OF SECTION

## SECTION 01700 - PROJECT CLOSEOUT

### 1. DEMobilIZATION

The Contractor shall remove all equipment and materials from the Site on completion of the Works. All Contractor generated debris shall be removed and disposed of to the satisfaction of the Engineer and the Contractor shall leave the Site in a condition suitable to the Trust and other property owners where applicable and as approved by the Engineer.

Parking and temporary construction areas shall be regraded to prevent ponding of water and restored to their original condition to the satisfaction of the Engineer and all other restoration shall be completed by the Contractor to the Engineer's approval.

### 2. MEASUREMENT AND PAYMENT

#### A. DEMobilIZATION AND PROJECT CLOSEOUT

Payment for demobilization and project closeout will be made at the lump sum price stipulated in the Schedule of Prices for Item D-1 which price and payment shall be full compensation for disposal of all debris on the Site, removal of all equipment and materials from the Site, regrading and restoration of all temporary access roads and parking areas; final cleaning within all structures constructed by and used by the Contractor for performance of the Works; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 02100 - SITE PREPARATION

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of Site preparation as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. clearing and grubbing of vegetation, including: trees, hedges, weeds, debris, stumps and other plants in designated work area, and disposing and compacting of cleared and grubbed materials in designated on-Site spoil area;
2. demolishing coal tipple structures and storm sewer piping, transferring debris to on-Site spoil area; and compacting demolition debris in designated on-Site spoil area;
3. relocating existing sediment and debris stockpiles to designated on-Site spoil area and compacting sediment and debris in designated on-Site spoil areas;
4. grading designated work area; and
5. supply and installation of a compacted layer of clean imported granular material over designated work area.

##### B. Related Work Specified in Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

1. Excavating and Backfilling, Section 02220.

#### 1.02 JOB CONDITIONS

##### A. Existing Conditions

The groundwater treatment system work area is in Grids 1-6, 1-7, 1-8, 2-7 and 2-8. Site support areas including Site offices, personnel and equipment decontamination facilities, parking, etc. will be located in Grids 1-3, 1-4, 1-5, 1-6 and 2-3 as shown on the Drawings. The Contractor is required to prepare the Site support area which also will be used as a Site supply area by other Contractors.

All stormwater from rainfall events on the Site presently drain into and is contained by the on-Site East and West ponds. During performance of the Works, the Contractor shall ensure that all stormwater on the Site is contained and diverted to these existing on-Site ponds.

**B. Environmental Requirements**

The Contractor shall suppress and control the generation of dust and particulate emissions at all times in accordance with Section 01500 and Section 01121. The excavation area shall be maintained in dry condition in accordance with Section 01500.

**C. Protection**

The Contractor shall protect fencing, monitoring wells, piezometers, extraction wells, benchmarks, pavement, utility lines, Site appurtenances, trees, root systems of trees, shrubs, plants and other features not required or specified to be cleared or removed.

The Contractor shall prevent accidental fires and fire damage and shall take fire protection measures necessary to meet requirements of authority having jurisdiction, including provision of fire-fighting equipment on standby at all times.

During demolition activities the Contractor shall prevent movement, settlement or damage of adjacent areas, structures, services, utilities, adjacent grades to remain or any other item not specified to be demolished.

**D. Sequencing and Scheduling**

Prior to commencing construction of the groundwater treatment facility, the Contractor shall prepare the work area in the following sequence:

1. demolish existing coal tipple structure;
2. clear and grub work areas;
3. prepare the support areas for temporary construction facilities; and
4. relocate existing sediment and debris stockpiles.

**1.03 SUBMITTALS**

**A. General**

The Contractor shall comply with Section 01300.

**B. Granular Material**

The Contractor shall submit to the Engineer the proposed source of granular materials to be incorporated into the works and test results confirming suitability of the materials for the purpose intended at least 14 days prior to commencing construction of the compacted granular layer.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

Materials shall be selected by the Contractor for the purpose intended and shall be subject to the Engineer's approval prior to use.

## 2.02 MATERIALS

### A. Polyethylene Sheeting

Polyethylene sheeting shall be continuous sheeting of 0.006 inch (6 mil) thickness fabricated from single ply of polyethylene plastic, in widths and lengths suitable to minimize joints and overlapping.

### B. Granular Fill

Granular material used for gravel surface area and Decontamination Facility shall conform to Ohio DOT, Table 703-1 "Sizes of Coarse Aggregates, Size No. 68.

## PART 3 - EXECUTION

### 3.01 PREPARATION

The Contractor shall notify the Engineer prior to commencing clearing and grubbing and demolition operations. Dust suppression systems and the soil erosion and sediment control measures as specified shall be in place before commencing with clearing and grubbing, and demolition operations.

### 3.02 PERFORMANCE

#### A. Clearing and Grubbing

The Contractor shall clear and grub all vegetation including trees, stumps, grass, debris, rubbish, down timber, logs, brush, undergrowth and hedges within the limit of the work area as shown on the Drawings.

All above and below ground portions of trees and shrubs shall be grubbed out and cut and/or broken into manageable size pieces suitable for compaction, transported to and disposed in designated on-Site spoil areas. Cleared and grubbed materials shall be compacted in layers not exceeding 12 inches after compaction in on-Site spoil areas.

#### B. Demolition and Removal

##### (1) Coal Tipple and Other Structures

The Contractor shall demolish the existing coal tipple and associated structures to the extent that its concrete slabs and foundations do not interfere with the final design grades, lines and elevations shown on the Drawings or are within the zone to be occupied by final soil cover.

Concrete structures not requiring removal shall be fractured and left in place in a manner to allow free groundwater movement after construction of the final soil cover.

The Contractor shall carefully break concrete within specified demolition limits by mechanical means using air tools, hydraulic tools, drilling and wedging, or any other means approved by the Engineer. Blasting will not be permitted.



Demolition debris shall be broken or otherwise cut into sizes suitable for transportation to, disposal and compaction in layers not exceeding 12 inches in thickness at the on-Site spoil area.

The Contractor shall load demolition debris into approved haulage units for transportation and on-Site disposal as specified or as directed by the Engineer. Loading shall be performed in such a manner as to suppress and control dust generation and to maintain the loading area adjacent to the demolition area in a neat and tidy manner.

The Contractor shall backfill the voids created by the removal of the coal tipple and associated structures to the lines and grades shown on the Drawings. The Contractor shall backfill with approved native fill material in layers not exceeding 12 inches after compaction, to 90% of maximum dry density as determined in accordance with ASTM D698.

The Contractor shall comply with the dewatering requirements of Section 01500.

(2) Storm Sewer

The Contractor shall excavate and transfer to designated on-Site spoil areas, sections of existing storm sewer piping as shown on the Drawings or encountered during excavation and demolition activities. Storm sewer piping transferred to on-Site spoil areas shall be crushed and compacted in designated spoil areas with other demolition debris and soils.

C. Preparation of Support Area

The Contractor shall grade the Site support areas as shown on the Drawings. Excess native soils shall be transferred to the on-Site spoil area shown on the Drawings. The Contractor shall supply and place a six-inch layer of clean imported granular material over the graded Site support area, and shall ensure that all surface water drainage is directed to the on-Site ponds. The subgrade and granular layer shall each be compacted to 95% maximum dry density determined in accordance with ASTM D698. All construction facilities shall be installed in the Site support areas on the clean imported granular fill layer.

D. Relocation of Sediment and Debris Stockpiles

The Contractor shall relocate the existing sediment and debris stockpiles from the work area to the designated on-Site spoil area shown on the Drawings. The material in the existing sediment and debris stockpiles shall be handled as being potentially contaminated material, and shall be placed in the designated spoil area in layers not exceeding 12 inches in thickness and compacted to 90 percent of maximum dry density. Placing and compaction of debris and sediment at the on-Site spoil area shall be done in such a manner to ensure that the filling of all voids with sediments is accomplished.

## **PART 4 - MEASUREMENT AND PAYMENT**

### **4.01 CLEARING AND GRUBBING**

Payment for cleaning and grubbing will be made at the lump sum price stipulated in the Schedule of Prices for Item E-1 which price and payment shall be full compensation for supply of all labor, equipment, plant and materials required to perform clearing and grubbing activities; cutting, placing and compacting cleared and grubbed materials in designated on-Site spoil areas; excavation and crushing of storm sewer piping; and all other miscellaneous items for which separate payment is not provided under other Items.

### **4.02 DEMOLITION OF COAL TIPPLE**

Payment for demolition of Coal Tipple will be made at the lump sum price stipulated in the Schedule of Prices for Item E-2 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to demolish the coal tipple; break debris into manageable size pieces; load and transport debris and soils to on-Site stockpile area; place and compact debris and soils in stockpile area; dust suppression; and all other miscellaneous items for which separate payment is not provided under other Items.

### **4.03 PREPARATION OF THE SUPPORT AREA**

Payment for preparation of the support area will be made at the lump sum price stipulated in the Schedule of Prices for Item E-3 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to prepare the support area; final grading and compaction of the support area; supply and installation of a layer of clean granular material; dust suppression; surface water drainage; compaction; and all other miscellaneous items for which separate payment is not provided under other Items.

### **4.04 RELOCATION OF SEDIMENT AND DEBRIS STOCKPILES**

Payment for relocation of sediment and debris stockpiles will be made at the lump sum price stipulated in the Schedule of Prices for Item E-4 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to relocate sediment and debris stockpiles to on-Site soil staging area; excavating, loading, hauling, dumping, stockpiling and compacting sediment and debris; dust suppression; and all other miscellaneous items for which separate payment is not provided under other Items.

**END OF SECTION**

## SECTION 02220 - EARTHWORKS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of excavating and backfilling as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. installation of a temporary soil berm in Grid 2-7 and Grid 2-8 to ensure water from the east pond remains outside the work area;
2. excavation of pond sediments from Grids 2-7 and 2-8 within the work area and placing sediments at contaminated soil staging area in Grids 2-4, 2-5 and 2-6;
3. proofroll work area prior to regrading;
4. regrading of the work area in Grids 1-7, 1-8, 1-6, 2-7 and 2-8 to required subgrade elevations and placing of a six-inch layer of clean imported loam material over the work area;
5. excavation for foundations of groundwater treatment facility;
6. excavation of new surface water drainage ditch; and
7. excavation for and backfill of power/control conduits, rip-rap discharge apron, gravity discharge pipe, forcemain from water supply well, and septic holding tank.

##### B. Related Work Specified in Other Sections

The following items or work related to the work of this Section are specified in other Sections as noted:

1. Site Preparation, Section 02100
2. Restoration, Section 01015
3. Loam Soil Final Cover, Section 02264
4. Topsoiling and Vegetation, Section 02900

##### C. Terminology

Excavation and trenching shall mean the removal of all materials of whatever nature encountered in the Works whether wet, frozen or otherwise and shall include boulders, weathered rock, partially cemented materials, concrete, pavements and rock which can be removed by ripping or heavy duty mechanical excavation equipment without drilling and blasting.

Bedding means the material used to support a pipe, and extends up to the horizontal line 12 inches above the top of the pipe.

Cover material means the final two feet of clean imported loam and topsoil material to be placed over the area of the Work.

## 1.02 QUALITY ASSURANCE

### A. General

Material excavated from the Works will be judged suitable or unsuitable for backfilling by the Engineer in accordance with specified requirements for excavated material to be used as backfill in the Works.

Excess or unsuitable excavated material shall not be removed from the Site.

### B. Source Quality Control

The Contractor shall inform the Engineer of source of materials to be incorporated into the Works and provide access to the source and processed material for the purposes of sampling and testing prior to delivery to the Site. The Contractor shall provide the Engineer with sufficient documentation showing the source of materials complies with the specified requirements for the use of the material.

If in the opinion of the Engineer, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, the Contractor shall obtain an alternate source or demonstrate that material from the source in question can be processed to meet specified requirements.

Should a change of material source be proposed during the Works, the Contractor shall advise the Engineer sufficiently in advance of proposed change to allow sampling and testing.

Acceptance of a material at source or failing conduct of sampling and testing at source by the Engineer does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

The Contractor shall bear the cost of sampling and testing of materials which fail to meet specified requirements.

## 1.03 SUBMITTALS

### A. General

The Contractor shall comply with Section 01300.

### B. Source of Materials

The Contractor shall submit to the Engineer the location of the proposed source of granular material at least 14 days prior to commencing transport of materials to the Site in order for the Engineer to sample and test the material to determine compliance with these specifications. The Contractor shall submit evidence, in the form of chemical

analysis that the material is free of any hazardous substances, for each material source to the Engineer at least 14 days prior to transporting the material to the Site.

C. Geotechnical Data

The Contractor shall submit to the Engineer grain size distribution curves for each classification of material prior to its installation. Each grain size distribution curve shall show the average distribution and the minimum and maximum variation in gradation.

1.04 PRODUCT DELIVERY AND HANDLING

A. Delivery

The Contractor shall handle and transport materials at all times in a manner and with equipment that will avoid segregation and contamination by any deleterious material.

B. Storage and Handling

When necessary, and only if approved by the Engineer, the Contractor may stockpile imported granular material on the Site in approved locations designated by the Engineer.

The Contractor shall ensure that stockpile sites are level, well drained, free of foreign materials and of adequate bearing capacity to support the weight of the materials to be placed thereon. Stockpiles shall be either far enough apart or separated by substantial dividers to prevent intermingling.

Except where material is stockpiled on acceptably stabilized areas, the Contractor shall provide a suitable base to prevent contamination of the piled material or place material on the ground, provided that the bottom of the pile is not incorporated into the Works and in any case, materials supporting stockpiles shall not be used in the Works.

The Contractor shall provide and maintain access to stockpile areas and stockpile materials in a manner to prevent segregation and upon completion of the Works shall load and haul excess material to a designated disposal location on-Site or spoil adjacent to the excavation when authorized by the Engineer.

Equipment and methods of handling material shall be such as to prevent contamination by foreign material, intermixing, segregation and breakage.

1.05 JOB CONDITIONS

A. Existing Conditions

(1) Existing Utilities and Structures

The Contractor shall confirm locations of buried utilities and structures by careful test excavations.

(2) Existing Surface Features

The Contractor shall repair damage resulting from the Works as described in Section 01015.

Where fencing is required to be removed, the Contractor shall obtain approval from the Engineer prior to removal and shall remove by dismantling carefully and store and protect the components until required for reinstallation.

B. Environmental Requirements

The Contractor shall dewater excavations in accordance with Section 01500.

Water from the excavations shall be discharged into the on-Site ponds, or if the on-Site ponds are full, water from excavations shall be stored on Site in Contractor-supplied storage units until the water can be treated by the completed on-Site water treatment facility.

The Contractor shall prevent runoff from entering any excavations and damage due to surface run-off.

The Contractor shall suspend operations whenever climatic conditions, as determined by the Engineer, are unsatisfactory for placing fill to the requirements of this Section.

After occurrence of heavy rains, the Contractor shall not operate equipment on previously placed material or on approved excavations until the material has dried sufficiently to prevent occurrence of excessive rutting.

Fill shall not be placed in a frozen state or against frozen excavations or previously placed material. Fill shall not be placed on snow, ice, water or other objectionable material or on improperly prepared excavations or previously placed material.

Where excavations or previously placed material have been softened or eroded, the Contractor shall remove soft and yielding material or otherwise objectionable or damaged areas and replace with compacted fill as specified at no additional cost to the Trust.

C. Protection

The Contractor shall maintain and protect from damage all utilities and structures encountered. In the event of disturbance of, or damage, to any utility or structure, the Contractor shall immediately notify the Engineer.

The Contractor shall protect structures and pipelines from any uplift or disturbance during placement and compaction of backfill material.

The Contractor shall employ procedures for extracting sheeting, placing backfill and discontinuing groundwater control such that they ensure the backfill load is applied gradually and disturbance of utilities, structures and their foundations is avoided.

The Contractor shall protect and ensure the stability of excavations and open excavations against flooding and damage due to surface run-off or water from any source.

In the event of damage, the Contractor shall replace or repair damage as directed by the Engineer at no additional cost to the Trust.

## PART 2 - PRODUCTS

### 2.01 GENERAL

#### A. Sources of Imported Material

Materials shall be provided from a source or sources approved by the Engineer.

### 2.02 MATERIALS

#### A. Native Fill

Native fill for backfilling purposes shall be selected material from excavations and trenches or other sources, approved by the Engineer. Approved material shall mean material that is free of the following unsuitable materials as determined by the Engineer.

Unsuitable materials include the following:

1. material containing loam, roots, vegetable matter, cinders, sod or refuse;
2. frozen material or material containing snow or ice;
3. rocks and lumps of material with dimensions greater than 50% of the specified layer thickness before compaction;
4. other deleterious or foreign matter detrimental to the use intended;
5. trees, stumps, or any other wood or lumber;
6. wire, steel, cast iron, cans, drums or any other foreign materials; and
7. materials containing hazardous or toxic constituents at hazardous or toxic concentrations.

#### B. Granular Material

Granular material used for gravel surface areas shall conform to Ohio DOT Table 703-1, "Sizes of Coarse Aggregate", size number 68.

#### C. Bedding Material

Material used for pipe and conduit bedding shall conform to Ohio DOT Table 703-1, "Sizes of Coarse Aggregate", size number 10.

#### D. Rip-Rap

Rip-rap shall be unweathered, durable igneous, metamorphic or sedimentary rock and shall be free from organic, mica, shale or other unsuitable material.

Individual rock fragments shall be hard, dense, sound and resistant to abrasion and shall be free of cracks, seams and other structural defects that would tend to increase unduly their destruction by water and frost action and handling. Rock exhibiting marked deterioration by water or weather shall not be used.

Bulk specific gravity of rock fragments, determined on saturated surface - dry basis in accordance with ASTM C127 or C97, as applicable, shall be minimum 2.65.

Rip-rap shall be reasonably well graded and shall meet minimum specified size distribution.

Rock size for rip-rap shall be such that d50 (size) is 4 inches.

E. Polyethylene Sheeting

Polyethylene sheeting used for covering soil stockpiles shall be continuous sheeting of 6 mil (0.006 inch) thickness fabricated from single ply polyethylene plastic in widths and lengths suitable to minimize joints and overlapping.

PART 3 - EXECUTION

3.01 PREPARATION

Excavation and backfilling activities shall be carried out in strict accordance with the Contractors approved Site-specific Health and Safety Plan.

Unless otherwise specified, the Contractor shall advise the Engineer a minimum of two (2) work days in advance of excavation operations to enable the Engineer to take pre-excavation cross-sections.

The Contractor shall remove fencing, guardrail and other surface features or obstructions, ice and snow, from surfaces to be excavated within required limits.

3.02 INSPECTION

The Contractor shall not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, measurements, tests or approvals.

The Contractor shall obtain approval from the Engineer for excavations and previously placed material prior to placement of successive lifts.

The Contractor shall obtain approval from the Engineer prior to placing fill against structures or around exposed buried utilities.



### 3.03 PERFORMANCE

#### A. Excavation

##### (1) General

The Contractor shall excavate to lines, grades, elevations and dimensions shown on the Drawings.

During excavation, the Contractor shall not interfere with normal 45° splay of bearing from bottom of any concrete structure.

The rules of OSHA and the State Department of Labor with respect to excavation and construction shall, at all times, be strictly observed.

##### (2) Pond Sediment Removal

The Contractor shall undertake adequate measures either in the form of an earth dyke or sheeting to prevent water from the ponds entering the excavated area. The Contractor shall excavate the two (2) feet of pond sediments within the work area, place excavated sediments in haulage units and transport sediments to the contaminated soil staging area, where it shall be stockpiled and securely covered with polyethylene sheeting.

Additional sediments removed below the top two feet of sediments shall be transported to and stockpiled at the on-Site spoil area.

##### (3) Surface Water Drainage Ditch

The Contractor shall excavate to the lines and grades shown on the Drawings, for the new surface water drainage ditch.

The top 24 inches of soils in Grid 2-6 within the alignment of the new surface water drainage way shall be kept separate from other soils and shall be transferred to the contaminated soil staging area as shown on the Drawings, and shall be covered with adequately restrained 6 mil polyethylene sheeting. The remaining excavated material shall be transferred to the on-Site spoil area, where it shall be spread in layers not exceeding 12 inches in thickness, and shall be compacted to at least 90 percent maximum dry density as determined in accordance with ASTM D698.

##### (4) Trenching

Unless otherwise specified or indicated, any method of excavation which will not damage or endanger adjacent structures or property or disturb the natural or fill soils below and adjacent to the excavation may be used.

In no case during performance of the Works shall excavation advance more than 100 feet ahead of the active installation.

The Contractor shall hand trim, make firm and remove loose material and debris from trenches. Where material at bottom of excavation is disturbed, the Contractor shall compact foundation soil to density at least equal to undisturbed soil.

The Contractor shall not obstruct flow of surface drainage or natural watercourses.

The Contractor shall excavate to leave earth bottoms of excavations undisturbed, level, free from loose, soft or organic matter.

The Contractor shall notify the Engineer when soil at bottom of the excavation appears unsuitable and proceed as directed by the Engineer.

The Contractor shall remove unsuitable material from trench bottom to extent and depth directed by the Engineer in accordance with this Section.

Trenches shall be of the necessary width for proper laying of pipe. The banks of pipe trenches shall be as nearly vertical as practicable. Care shall be taken not to overexcavate. The bottom of trenches shall be accurately excavated and graded to provide uniform bearing and support for each section of the pipe on full thickness of approved bedding material at every point along its entire length except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper jointing of pipe. Bell holes and depressions for joints shall be dug after the trench bottom has been graded to specified level, and, in order for the maximum length of pipe to rest on the prepared trench bottom as practicable, bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joint. Stones shall be removed as necessary to avoid point bearing. Except as hereinafter specified for wet or otherwise unstable material, overexcavated areas shall be backfilled with pipe bedding materials specified for backfilling the lower portion of trenches. Excavation and backfill of overexcavated areas shall be at the Contractors sole cost.

(5) Overexcavation

Where, in the opinion of the Engineer, the undisturbed condition of the soils is inadequate for the support of the piping or conduits, the Contractor shall overexcavate to adequate supporting soils as directed by the Engineer, and refill the excavated space with approved material to the proper elevation in accordance with the procedure specified for backfill. Where so directed by the Engineer and except as otherwise specified, the excavation and removal of inadequate material as specified, furnishings and placement of such material in excess of the quantities shown on the Drawings shall be paid for under the payment items of this Section, or in the absence of adequate pay items as determined by the Engineer, shall be paid for under the appropriate item of the Additional Unit Prices or as Extra Work. All such overexcavated material may be used in the Works or shall be spoiled on the Site as approved by the Engineer and shall be placed and compacted as specified.

Should unauthorized excavation be carried below the lines and grades indicated on the Drawings because of the Contractor's operations including errors, methods of construction or to suit his convenience, the Contractor shall refill such excavated space to the proper elevation as directed. Should the natural or fill foundation soils be disturbed or loosened because of the Contractor's operations, they shall be recompacted or removed and the space refilled as directed by the Engineer at no additional cost to the Trust.

Where required, due to unauthorized over-excavation, the Contractor shall correct, at no additional cost to the Trust, as follows:

1. fill under concrete structures with concrete as specified in Section 03300; and
2. fill under other areas with specified imported granular material compacted to at least 95% maximum dry density as determined in accordance with ASTM D2922.

(6) Excavated Material

Excavated material approved by the Engineer for use as backfill in the Works shall be selected, loaded, hauled to required location, and if necessary, temporarily stockpiled until required in locations approved by the Engineer.

Excavated material not approved by the Engineer for use as fill in the Works including boulders, debris, brush, roots or other perishable matter will be classified unsuitable for fill by the Engineer and shall be disposed of in specified on-Site spoil areas.

The Contractor shall dispose of waste material and surplus and unsuitable excavated material to designated areas on Site as directed by the Engineer. All materials brought to the on-Site designated material stockpile area shall be spread in uniform layers, not exceeding 12 inches in compacted thickness. The Contractor shall compact each layer to 90 percent of maximum dry density in accordance with ASTM D698, unless specified otherwise.

B. Backfilling

The Contractor shall not proceed with backfilling operations until the Engineer has inspected and approved the installations.

Areas to be backfilled shall be free from debris, snow, ice, water or frozen ground.

The Contractor shall not use backfill material which is frozen or contains ice, snow or debris.

The Contractor shall backfill around installations as follows:

1. bedding and surround material for underground piping shall be placed as specified on the Drawings;
2. except as provided for elsewhere, backfill around or over cast-in-place concrete shall not be placed within 72 hours of concrete placing;
3. layers shall be placed simultaneously, on both sides of installed work to equalize loading;
4. material shall be placed by hand, under, around and over installations until two feet (2') of cover is provided; backfill shall not be dumped directly on installations; and
5. granular fill material shall be in layers not exceeding 6 inches in depth.

The Contractor shall place backfill material continuously and in uniform layers, not exceeding 6 inches compacted thickness, unless specified otherwise, up to grades shown on the Drawings.

The Contractor shall compact each layer before placing succeeding layer as specified.

The Contractor shall use fill of types specified and shown on the Drawings.

Where excavated material is insufficient in quantity to complete backfilling, the Contractor shall backfill with an approved clean material in accordance with the requirements specified for native fill. The Contractor shall use select native fill material approved for backfilling before using imported backfill.

C. Rip Rap Installation

Where rip rap is to be placed adjacent to discharge pipes, concrete or structures, the Contractor shall exercise caution so as not to damage or displace the structures.

The Contractor shall place rip rap by suitable methods so that rip rap does not mix with or damage foundation material and to ensure minimum breakage of individual pieces during placing.

Rip rap shall be placed in accordance with layer thicknesses and details shown on the Drawings.

Rip rap shall be placed in an approved manner to secure the surface and to provide a stable mass.

Larger rock shall be uniformly distributed over the entire area and the remainder uniformly distributed with smaller pieces filling voids between larger pieces.

The Contractor shall finish surfaces in such a manner to ensure they are stable, reasonably uniform, free from bumps or depressions with no excessively large cavities below or individual rock pieces projecting above the general surface.

D. Degree of Compaction

The Contractor shall compact each layer of backfill placed as follows:

1. Under Roadways and Similar Use Pavements Including Adjacent Shoulder Areas

At least 95% of maximum dry density determined in accordance with ASTM D698 up to the elevations at which the requirements for pavement subgrade materials apply.

2. Under Concrete Slabs on Grade

At least 98% of maximum dry density in accordance with ASTM D698 up to the underside of the concrete slab.

3. Under Lawn Seeded Areas

At least 90% of maximum dry density determined in accordance with ASTM D698 up to the elevations at which the requirements for landscaping apply; thickness of each layer shall not exceed 12 inches.

E. Proofrolling

The Contractor shall proofroll all subgrades prior to placing any fill, using a 10-ton static weight non-vibratory roller or equivalent.

3.04 FIELD QUALITY CONTROL

A. Quality Control by Engineer

A testing firm hired and approved by the Engineer will perform tests in the field and in the laboratory on samples of compacted fill to determine if materials meet the specified requirements and except as otherwise specified, tests will be at the expense of the Trust. Copies of test reports will be supplied to the Contractor on request.

B. Frequency of Testing by Engineer

At least one density test and one moisture content determination for each lift placed will be made.

At least one particle size analysis will be made for any change in material being used in the backfill.

The method used and the frequency of such tests will be determined by the Engineer. When the Contractor disputes the results of any test, further tests will be taken but the decision to use any test method other than the one chosen shall be made only by the Engineer.

C. Methods of Testing by Engineer

Maximum density of fill will be determined in accordance with ASTM D698.

Bulk density will be determined in the field in accordance with ASTM D1556 or with ASTM D2167 or with ASTM D2922, whichever is most suitable to obtain representative density of soil tested.

Particle size analysis will be performed in accordance with ASTM D422 or ASTM D1140, whichever is appropriate to material tested.

Moisture content of backfill in place will be determined in accordance with ASTM D3017.

D. Failure to Meet Specified Requirements

When tests indicate that the required degree of compaction is not achieved or cannot be obtained with the equipment in use or the procedure being followed for the material being compacted the Contractor shall, at his sole expense, modify his operations so that the equipment and procedures will produce the required results. Additional testing required by the Engineer shall be at the Contractor's sole expense.

The generality of the foregoing does not preclude employing other measures to achieve specified results including but not necessarily limited to additional passes of compaction equipment, additional ballast, removing and replacing material, reduction in lift thickness, or wetting or drying material.

### **3.05    ADJUSTMENT AND CLEANING**

The Contractor shall finish surfaces to establish grade but not uniformly high or low. Surface irregularities shall be corrected by loosening and adding or removing material until surface is within specified grade.

The Contractor shall clean and re-instate work areas and areas affected by equipment outside areas specified to be excavated, to specified restoration condition.

Upon completion of backfilling, the Contractor shall remove all excess material and debris from work areas, roads, ditches, and leave ditches in a properly graded condition sloped as required to permit proper drainage and free of depressions that will pond or collect water or debris which will restrict flow.

## **PART 4 - MEASUREMENT AND PAYMENT**

### **4.01    POND SEDIMENT REMOVAL**

#### **A.    Measurement**

Measurement for pond sediment removal will be made at the actual number of cubic yards of pond sediment excavated as measured in place by the Engineer, calculated using the average end area method from cross-sections taken prior to and following completion of excavation and backfilling operations.

#### **B.    Payment**

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-1 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to excavate top two feet of sediment from east pond within the work area; transfer sediments to contaminated soil staging area; cover sediments with 6-mil polyethylene sheeting; partial pond dewatering; dust control; and all other miscellaneous items for which separate payment is not provided under other Items.

### **4.02    SURFACE WATER DRAINAGE DITCH**

#### **A.    Measurement**

Measurement for the surface water drainage ditch will be made at the actual number of cubic yards of material excavated as measured by the Engineer, calculated using the average end area method from cross-sections taken prior to and following excavation operations.

#### **B.    Payment**

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-2, which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for excavation of the new surface drainage ditch; loading, haulage, stockpiling, spreading and compaction of excavated materials at on-Site spoil areas; covering and securing

material placed in the contaminated soil staging area; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.03 REGRADE THE WORK AREA

##### A. Measurement

Measurement for regrading the work area will be made at the actual number of cubic yards of material excavated as measured in place by the Engineer, calculated using the average end area method from cross-sections taken prior to and following completion of regrading operations.

##### B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-3 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for excavating native soils in the Work area for the purpose of regrading the work area to subgrade elevations; loading and hauling excavated native soils to backfill areas or designated spoil areas; placing and compacting excavated native soils in backfill or designated spoil areas; dust control; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.04 GRANULAR FILL FOR PERMANENT ACCESS ROADS

##### A. Measurement

Measurement for granular fill for permanent access roads will be made at the actual number of cubic yards of material installed as measured in place by the Engineer, and calculated using the average end area method from cross-sections taken after excavation and proofrolling (where applicable) and on completion of fill operations.

##### B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-4 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to supply and transport granular fill to the Site; temporary stockpiling, if required; placing, spreading, mixing, breaking down, watering and compacting material in layers; dust control; and all other miscellaneous items for which separate payment is not provided under other items.

#### 4.05 RIP RAP

##### A. Measurement

Measurement for rip-rap will be made at the actual number of cubic yards of material installed as measured by the Engineer, calculated using the average end area method from cross-sections taken prior to and following completion of rip rap fill operations.

B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-5 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for supply and placement of rip rap; and all other miscellaneous items for which separate payment is not provided under other items.

END OF SECTION



## SECTION 02237 - STRUCTURAL FILL

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of structural fill as specified and as shown on the Drawings.

#### 1.02 QUALITY ASSURANCE

##### A. Testing Agency

The Contractor shall retain a qualified testing agency to conduct a geotechnical analysis, confirming the suitability of his proposed structured fill material for incorporation into the Work.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Source of Materials

The Contractor shall submit to the Engineer the proposed source of materials to be incorporated into the Work and test results confirming suitability of the materials for the purpose intended at least 14 days prior to commencing construction of the structural fill including any change in material source during performance of the Work.

##### C. Geotechnical Data

The Contractor shall submit to the Engineer grain size distribution curves for each classification of material at least 14 days prior to commencing construction of the structural fill.

#### 1.04 PRODUCT DELIVERY AND HANDLING

##### A. Delivery

The Contractor shall handle and transport materials at all times in a manner and with equipment that will avoid segregation and contamination by any deleterious material.

##### B. Storage and Handling

When necessary, as approved by the Engineer, the Contractor shall stockpile material on the Site in approved locations designated by the Engineer.

The Contractor shall ensure provision of stockpile sites that are level, well drained, free of foreign materials and of adequate bearing capacity to support the weight of the materials to be placed thereon. Stockpiles shall be either far enough apart or separated by substantial dividers to prevent intermingling.

The Contractor shall provide and maintain access to stockpile areas.

1.05 JOB CONDITIONS

A. Environmental Requirements

(1) General

The Contractor shall suspend operations whenever climatic conditions, as determined by the Engineer, are unsatisfactory for placing material to the requirements of this Section.

After occurrence of heavy rains, equipment shall not be operated on previously placed material or on approved excavations until the material has dried sufficiently to prevent rutting.

Structural fill shall not be placed in a frozen state or against frozen excavations or previously placed frozen material. Structural fill shall not be placed on snow, ice, water or other objectionable material or on improperly prepared excavations or previously improperly placed material.

Where excavations or previously placed material have been softened or eroded, the Contractor shall remove soft and yielding material or otherwise objectionable or damaged areas and replace with compacted fill as specified.

(2) Dust Control

During all work activities related to construction of structural fill, the Contractor shall keep the Site, adjacent areas and haul routes free from dust and airborne particulate matter as specified in Section 01500.

(3) Dewatering

The Contractor shall keep the Works free of water in accordance with Section 01500.

C. Protection

When placing and compacting structural fill, the Contractor shall not disturb satisfactorily placed material or structures already in place.

The Contractor shall not route or permit traffic to travel over in-place structural fill without approval from the Engineer.

The Contractor shall maintain and protect from damage all utilities, structures, monitoring wells, piezometers, manholes, gravel access roads, and security fences remaining in service. In the event of disturbance or damage of any utility or structure the Contractor shall immediately notify the Engineer.

The Contractor shall protect existing buildings and surface features which may be affected while work is in progress.

The Contractor shall protect existing buildings and structures where temporary unbalanced earth pressures are liable to develop on walls or other structures utilizing bracing, shoring or other approved methods to counteract unbalance.

Placement, haulage or any other construction equipment that may cause damage to soil layers, shall at no time operate upon such layers.

Immediately prior to temporary suspension of fill operations, the Contractor shall roll or grade filled surfaces under construction to grades specified so as to leave the surface free of ruts, depressions or areas that will pond or collect water.

D. Sequencing and Scheduling

The Contractor shall sequence delivery of materials to the Site in a manner to minimize stockpiling and in any event the Contractor shall obtain approval from the Engineer to stockpile.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Fill

Structural fill material shall be granular material complying with Ohio DOT Table 703-1, "Sizes of Coarse Aggregate", size number 68.

PART 3 - EXECUTION

3.01 PERFORMANCE

A. Structural Fill

The Contractor shall not proceed with fill operations until the Engineer has inspected and approved the installations.

Areas to be filled shall be free from debris, snow, ice, water or frozen ground.

The Contractor shall not use fill material which is frozen or contains ice, snow or debris.

The Contractor shall fill around installations as follows:

1. bedding and surround material for underground piping shall be placed as specified on the Drawings;
2. except as provided for elsewhere, fill around or over cast-in-place concrete shall not be placed within 72 hours of concrete placing;

3. layers shall be placed simultaneously, on both sides of installed work to equalize loading;
4. material shall be placed by hand, under, around and over installations until two feet (2') of cover is provided; fill shall not be dumped directly on installations; and
5. granular fill material shall be in layers not exceeding 6 inches in depth.

The Contractor shall place fill material continuously and in uniform layers, not exceeding six (6) inches compacted thickness, unless specified otherwise, up to grades shown on the Drawings.

The Contractor shall compact each layer before placing succeeding layer as specified.

B. Degree of Compaction

The Contractor shall compact each layer of structural fill placed to at least 98% of maximum dry density in accordance with ASTM D698 up to the underside of the concrete slab.

C. Proofrolling

The Contractor shall proofroll all subgrades prior to placing any fill, using a 10-ton static weight non-vibratory roller.

3.02 FIELD QUALITY CONTROL

A. Quality Control by Contractor

A testing firm hired by the Contractor shall perform tests in the field and in the laboratory on samples of compacted fill to determine if materials meet the specified requirements. Copies of test reports shall be supplied to the Engineer to confirm the material placed meet the specified requirements.

B. Frequency of Testing by Contractor

At least one density test and one moisture content determination for each lift placed shall be made.

At least one particle size analysis shall be made for any change in material being used in the backfill.

C. Methods of Testing

Maximum density of fill shall be determined in accordance with ASTM D698.

Bulk density shall be determined in the field in accordance with ASTM D1556 or with ASTM D2167 or with ASTM D2922, whichever is most suitable to obtain representative density of soil tested.

Particle size analysis shall be performed in accordance with ASTM D422 or ASTM D1140, whichever is appropriate to material tested.

Moisture content of backfill in place will be determined in accordance with ASTM D3017.

D. Failure to Meet Specified Requirements

When tests indicate that the required degree of compaction is not achieved or cannot be obtained with the equipment in use or the procedure being followed for the material being compacted the Contractor shall, at his sole expense, modify his operations so that the equipment and procedures will produce the required results. Additional testing required by the Engineer shall be at the Contractor's sole expense.

The generality of the foregoing does not preclude employing other measures to achieve specified results including but not necessarily limited to additional passes of compaction equipment, additional ballast, removing and replacing material, reduction in lift thickness, or wetting or drying material.

3.03 ADJUSTMENT AND CLEANING

The Contractor shall finish surfaces to establish grade but not uniformly high or low. Surface irregularities shall be corrected by loosening and adding or removing material until surface is within specified grade.

The Contractor shall clean and re-instate work areas and areas affected by equipment outside areas specified to be excavated, to specified restoration condition.

Upon completion of backfilling, the Contractor shall remove all excess material and debris from work areas, roads, ditches, and leave ditches in a properly graded condition sloped as required to permit proper drainage and free of depressions that will pond or collect water or debris which will restrict flow.

PART 4 - MEASUREMENT AND PAYMENT

4.01 STRUCTURAL FILL

A. Measurement

Measurement for structural fill will be made at the actual number of cubic yards of structural fill installed as measured in place by the Engineer, and calculated using the average end area method from cross-sections taken after excavation and proofrolling (where applicable) and on completion of fill operations.

B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item G-1 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to supply and transport structural fill to the Site; temporary stockpiling, if required; placing, spreading, mixing, breaking down, watering and compacting material in layers; dust control; and all other miscellaneous items for which separate payment is not provided under other items.

END OF SECTION

## SECTION 02264 - LOAM FILL

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of loam fill as specified and as shown on the Drawings.

#### 1.02 QUALITY ASSURANCE

The Contractor shall construct the loam fill layer to the lines and grades shown on the Drawings. A tolerance of plus or minus 0.1 foot shall be allowed on the finished elevations of the loam layer.

If in the opinion of the Engineer, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, the Contractor shall obtain an alternate source or demonstrate that material from the source in question can be processed to meet specified requirements.

Should a change of material source be proposed during the Works, the Contractor shall advise the Engineer sufficiently in advance of a proposed change to allow sampling and testing to be completed by the Engineer.

Acceptance of a material at source or failing conduct of sampling and testing at source by the Engineer does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

The Contractor shall bear the cost of sampling and testing of materials which fail to meet specified requirements.

The Contractor shall provide the Engineer access to the source and processed material for the purposes of sampling and testing at least 14 days prior to delivery to the Site.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Source of Materials

The Contractor shall submit to the Engineer the name and location of the proposed source of loam fill to be incorporated into the Works at least 14 days prior to commencing production, including any change in material source during performance of the Works.

C. Geotechnical Data

The Contractor shall submit to the Engineer grain size distribution curves for loam at least 14 days prior to commencing production from any source.

1.04 PRODUCT DELIVERY AND HANDLING

A. Delivery

The Contractor shall handle and transport materials at all times in a manner and with equipment that will avoid segregation and contamination by any deleterious material.

B. Storage and Handling

When necessary, as approved by the Engineer, the Contractor shall stockpile material on the Site in approved locations designated by the Engineer.

The Contractor shall ensure provision of stockpile sites that are level, well drained, free of foreign materials and of adequate bearing capacity to support the weight of the materials to be placed thereon. Stockpiles shall be either far enough apart or separated by substantial dividers to prevent intermingling.

The Contractor shall provide and maintain access to stockpile areas.

Stockpiled material shall be covered with approved polyethylene sheeting of minimum 6 mil thickness to withstand adverse weather, wind and other detrimental forces. Covering shall provide total protection of stockpiled material from rain and other adverse weather effects.

Temporary stockpile slopes shall be maintained not steeper than 1.5 horizontal to 1 vertical.

Stockpiles shall not block natural drainage of surrounding area, and area surrounding stockpiles shall be maintained in neat and tidy condition.

The Contractor shall construct and maintain temporary stockpile areas in a properly drained and graded condition so that natural drainage of surrounding area will not be restricted and the area will be free of depressions that will pond or collect water. All surface water shall be diverted around and away from stockpile areas.

1.05 IOB CONDITIONS

A. Existing Conditions

During all Site activities, the Contractor shall maintain all the existing structures designated to remain in service. Any structure damaged due to the Contractor's operations shall be repaired immediately by the Contractor as specified by the Engineer at no additional cost to the Trust.

B. Environmental Requirements

(1) General

The Contractor shall suspend operations whenever climatic conditions, as determined by the Engineer, are unsatisfactory for placing material to the requirements of this Section.

After occurrence of heavy rains, equipment shall not be operated on previously placed material or on approved excavations until the material has dried sufficiently to prevent rutting.

Loam shall not be placed in a frozen state or against frozen excavations or previously placed frozen material. Loam shall not be placed on snow, ice, water or other objectionable material or on improperly prepared excavations or previously improperly placed material.

Where excavations or previously placed material have been softened or eroded, the Contractor shall remove soft and yielding material or otherwise objectionable or damaged areas and replace with compacted fill as specified.

(2) Dust Control

During all work activities related to construction of loam layer, the Contractor shall keep the Site, adjacent areas and haul routes free from dust and airborne particulate matter as specified in Section 01500.

(3) Dewatering

The Contractor shall keep the Works free of water in accordance with Section 01500.

C. Protection

When placing and compacting loam, the Contractor shall not disturb satisfactorily placed material or structures already in place.

Surfaces of loam shall be crowned or sloped with grades shown on the Drawings so that surface will drain freely.

The Contractor shall not route or permit traffic to travel over in-place loam without approval from the Engineer.

The Contractor shall maintain and protect from damage all utilities, structures, monitoring wells, piezometers, manholes, gravel access roads, and security fences remaining in service. In the event of disturbance or damage of any utility or structure the Contractor shall immediately notify the Engineer.

The Contractor shall protect existing buildings and surface features which may be affected while work is in progress.

The Contractor shall protect existing buildings and structures where temporary unbalanced earth pressures are liable to develop on walls or other structures utilizing bracing, shoring or other approved methods to counteract unbalance.



Placement, haulage or any other construction equipment that may cause damage to loam or other layer, shall at no time operate upon such layers.

Immediately prior to temporary suspension of fill operations, the Contractor shall roll or grade filled surfaces under construction to grades specified so as to leave the surface free of ruts, depressions or areas that will pond or collect water.

D. Sequencing and Scheduling

The Contractor shall sequence delivery of materials to the Site in a manner to minimize stockpiling and in any event the Contractor shall obtain approval from the Engineer to stockpile.

PART 2 - PRODUCTS

2.01 LOAM FILL

Fill to be used for the loam final cover shall be clean, well graded imported sandy loam soil material free of unsuitable material as specified below. The maximum aggregate size shall be 2 inches measured through any axis and D<sub>10</sub> (particle size which 10 percent of particles by mass are smaller than) shall be less than 0.01 mm. The permeability of the sandy loam shall not exceed  $1 \times 10^{-4}$  cm/s.

Unsuitable materials shall mean materials which are not approved for use as determined by the Engineer and shall include the following:

1. frozen material or material containing snow or ice;
2. clays which are classified as inorganic clays of high plasticity in accordance with ASTM D2487;
3. soft and/or organic clays and silts of low strength;
4. frost susceptible silts or clays;
5. swelling clays;
6. trees, stumps, branches, or any other wood or lumber;
7. wire, steel, cast iron, cans, drums or any other foreign materials; and
8. materials containing hazardous or toxic constituents at hazardous or toxic concentrations.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall advise the Engineer in advance of placement of loam fill operations to enable the Engineer to take original cross-sections.

The Contractor shall ensure that areas to receive loam fill are free from debris, snow, ice, water or frozen ground.

### 3.02 INSPECTION

The Contractor shall obtain approval from the Engineer for material to be placed in the Works and for surfaces or previously placed material prior to placing loam fill.

### 3.03 INSTALLATION

#### A. Placing

The Contractor shall place loam fill continuously and in uniform layers not exceeding twelve (12) inches compacted thickness unless specified otherwise, up to grades shown on the Drawings. The Contractor shall compact each layer before placing succeeding layer as specified. Loam fill shall be placed without segregating material.

#### B. Compaction

The Contractor shall compact each layer of fill as specified to achieve the following densities:

1. Under Roadways and Similar Use Pavements  
Including Adjacent Shoulder Areas

At least 95% of maximum dry density determined in accordance with ASTM D698 up to the elevations at which the requirements for pavement subgrade materials apply; thickness of each layer shall not exceed 6 inches; and

2. Under Lawn-Seeded Areas

At least 90% of maximum dry density determined in accordance with ASTM D698 up to the elevations at which the requirements for landscaping apply; thickness of each layer shall not exceed 12 inches.

The Contractor shall apply water as is necessary during compaction to obtain specified density. If fill is excessively moist, the Contractor shall aerate with suitable equipment and methods until moisture content is corrected. In areas not accessible to rolling equipment, loam fill shall be compacted to specified density with mechanical tampers approved by the Engineer.

The type, size and efficiency of compaction equipment shall be approved by the Engineer and shall be capable of achieving the specified degree of compaction. When operating equipment adjacent to structures, the Contractor shall exercise care so as not to cause damage or displacement to the adjacent structure.

Whenever use of rollers is not practical, the Contractor shall compact the loam fill using hand-operated power tampers or other compaction equipment approved by the Engineer to achieve the specified degree of compaction for rollers.

### 3.04 FIELD QUALITY CONTROL

#### A. Quality Control by Engineer

The Engineer will select samples of uncompacted fill intended for the Works and samples of compacted fill in the Works. The Engineer will perform tests in the field and in the laboratory on samples of uncompacted and compacted fill to determine if materials meet the specification and except as otherwise specified, tests will be at the expense of the Trust. Copies of test reports will be supplied to the Contractor on request.

#### B. Frequency of Testing by Engineer

A minimum of one density test and one moisture content determination will be made for each 2,000 yd<sup>3</sup> placed, or more frequent as determined by the Engineer.

A minimum of one particle size analysis will be made for any change in material being used in the fill.

The method used and the frequency of such tests may be determined by the Engineer. When the Contractor disputes the results of any test, further tests will be taken but the decision to use any test method other than the one chosen will be made only by the Engineer.

#### C. Methods of Testing by Engineer

Maximum density of loam fill will be determined in accordance with ASTM D698.

Bulk density will be determined in the field in accordance with ASTM D1556 or with ASTM D2167 or with ASTM D2922, whichever is most suitable to obtain representative density of soil tested.

Particle size analysis will be performed in accordance with ASTM D422 or ASTM D1140, whichever is appropriate to material being tested.

Moisture content of loam fill in place will be determined in accordance with ASTM D3017.

#### D. Failure to Meet Specified Requirements

When tests indicate that the required degree of compaction is not achieved or cannot be obtained with the equipment in use or the procedure being followed, the Contractor shall modify his operations so that the equipment and procedures will produce the required results.

The generality of the foregoing does not preclude the Contractor employing other measures to achieve specified results including but not necessarily limited to additional passes of compaction equipment, additional ballast, removing and replacing material, reduction in lift thickness or wetting or drying material.

3.05 ADJUSTMENT AND CLEANING

The Contractor shall finish surfaces to established grade but not uniformly high or low. Surface irregularities shall be corrected by loosening and adding or removing material until surface is within specified grade.

The Contractor shall clean and reinstate work areas and areas affected by equipment outside areas specified to be excavated, to specified restoration condition.

Upon completion of filling, the Contractor shall remove all excess material and debris from work areas, roads, ditches and shall leave ditches in a properly graded condition sloped as required to permit proper drainage and free of depressions that will pond or collect water or debris that will restrict flow.

All stockpiled material designated to remain at the Site shall be adequately covered and erosion control measures implemented as approved by the Engineer.

PART 4 - MEASUREMENT AND PAYMENT

4.01 LOAM FILL

A. Measurement

Measurement for loam fill will be made at the actual number of cubic yards of loam soil final cover installed as measured in place by the Engineer, calculated using the average end area method from cross-sections taken prior to and following completion of loam fill operations.

B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item H-1 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to construct loam fill; supply and installation of loam soil layer; provision and maintenance of soil erosion and sediment control facilities; dust control; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 02366 - STEEL H PILES

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of steel H piles as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. supply, delivery, maintenance and removal of all equipment;
2. supply and installation of steel piles;
3. pile cut-offs; and
4. pile splicing.

##### B. Terminology

For the purposes of this specification, the following definitions apply:

##### 1. Bearing Pile

Means a pile whose principal purpose is to support vertical, or near vertical, loads.

##### 2. Bedrock Surface

Means the actual surface of the bedrock, weathered or unweathered, as it exists immediately below the overburden.

##### 3. Driving Shoe (Pile Shoe)

Means a reinforcement attached to the bottom of the pile and designed to protect the pile during driving.

##### 4. Follower

Means an intermediate structural piece for transmitting the blow from the hammer to the pile, especially used when installing piles below water level.

##### 5. Helmet (Cap Block)

Means a specially formed metal shape designed to receive the hammer blow and transmit it uniformly to the pile.

##### 6. Helmet Cushion

Means the material placed between the helmet and the hammer with the purpose of taking the blow and eliminating damage caused by direct impact. The material

should be such that it attenuates the peak impact force and transmits the impact energy without excessive losses.

7. Jetting

Means the use of a jet of water at high pressure directed into the ground below the pile to assist its entry. Compressed air is sometimes used depending on soil conditions.

8. Pile

Means a relatively slender structural element which is installed, wholly or partly in the ground by driving, drilling, augering, jetting or otherwise and derives its supporting capacity from the surrounding soil and from the soil or rock strata below its tip.

9. Pile cushion

Means the material placed between the pile and the helmet to avoid damage to the head of pile as a result of direct impact from the helmet.

1.02 QUALITY ASSURANCE

A. Supplier-Installer Qualifications

The Contractor shall employ only experienced personnel who are completely familiar with the required work. The Contractor shall provide adequate supervision by a qualified foreman.

B. Tolerances

(1) Material Straightness Tolerance

All steel piles shall conform to a straightness tolerances of 1 inch maximum in a length of 60 feet.

(2) Driving Tolerances

Piles shall be driven with a variation of not more than 1 inch in 3 feet from the vertical or from the batter shown on the plans, except that piles for trestle bents shall be driven to the tolerance shown on the plans.

If a tolerance is not shown on the plans, the piles for the trestle bents shall be driven with a variation of not more than 3 inches from their proper location, measured at the underside of the pier cap. The measurement for accuracy acceptability for trestle bent piles shall be measured while the piles are free standing and not deflected to force them into position.

After driving, pile heads shall be within 3 inches of locations indicated.

1.03 SUBMITTALS

A. General

The Contractor shall comply with Section 01300.

B. Test Reports

The Contractor shall submit certified mill test reports indicating yield and chemical analysis of steel piles.

C. Driving Records

The Contractor shall submit driving records of all piling in a form approved by the Engineer.

D. Equipment Information

Fourteen (14) days prior to commencement of piling, the Contractor shall submit to the Engineer for review, details of equipment for installation of piles, including manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer and driving cap.

1.04 PRODUCT DELIVERY AND HANDLING

A. Delivery

Piling material shall be delivered in a timely manner as required. During delivery the Contractor shall support long piles with webs in vertical position.

B. Storage and Handling

The Contractor shall store and handle piling to prevent damage to the material.

1.05 JOB CONDITIONS

A. Protection

The Contractor shall protect completed driven piles as required by the Engineer until incorporated into the concrete foundations.

The Contractor shall protect public and construction personnel, adjacent structures and work of other Sections from hazards attributable to pile driving operations.

B. Sequencing and Scheduling

The Contractor shall not commence piling operations until Site grading to pile cut-off or pregrade elevations is completed and approved by the Engineer.

The Contractor shall submit schedule of planned sequence of driving to Engineer not less than two weeks prior to commencement of pile driving.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Steel H Piles

Steel H piles shall conform to ASTM A36. Delivery length of pile shall be as follows: 11 pieces x 17 ft. and 22 pieces x 20 ft.

#### B. Welding Electrodes

Welding Electrodes shall be Class E70, low hydrogen conforming to ASTM A233.

#### C. Pile Shoes

Pile shoes shall be cast steel Hard Bite #77600 by Associated Pile and Fitting Corp., welded to the pile bottoms.

#### D. Pile Caps

Pile caps shall comply with ASTM A36.

## PART 3 - EXECUTION

### 3.01 PREPARATION

#### A. General

The Contractor shall not commence piling until Site grading to pile cut-off or pregrade elevations is completed and approved by the Engineer. Piling locations shall be laid out exactly as shown on the Drawings.

The Contractor shall ensure that ground conditions at pile locations are adequate to support pile driving operation and load testing operation. The Contractor shall make provision for access and support of piling equipment during performance of the piling operation.

#### B. Welding

Pile shoes shall be welded to the bottom of the piles in accordance with the manufacturer's recommendations and as shown on the Drawings and shall conform to AWS standards. Welding shall be done by qualified experienced welders.

#### C. Driving Equipment

##### (1) General

Driving hammers shall be either gravity, steam or diesel type.

Hammer energy per blow shall be rated at a minimum of 15 Kip-ft. When required penetration is not achieved by use of hammers complying with minimum



requirements, the Contractor shall provide a larger hammer, as approved by the Engineer.

(2) Gravity Type Hammers

The fall of drop hammers shall be capable of being regulated so that injury to the piles can be prevented.

Equipment for driving piles fitted with rock points shall also have controls to produce any height of fall of between 6 inches and 8 feet, and shall be able to efficiently maintain the desired fall.

(3) Steam and Diesel Hammers

Equipment for driving piles fitted with rock points shall be capable of delivering a controlled blow ranging in energy from 1/10 to full capacity.

(4) Helmets

The heads of piles shall be protected by helmets having adequate and suitable cushioning material next to the pile head and fitting into a casting which in turn supports a helmet cushion. The helmet shall distribute the blow of the hammer evenly throughout the cross-section of the pile head. The helmet shall be such that the axis of the pile is held in line with the axis of the hammer.

(5) Leads

Pile driver leads shall be built to afford freedom of movement for the hammer, and they shall be held in position at the top and bottom by guys, stiff braces, or other approved means, to ensure support to the pile while it is being driven.

Swinging leads shall not be permitted. Batter piles shall be driven with inclined leads.

(6) Followers

Followers shall not be used unless permitted in writing by the Engineer. When permitted, they shall be of a type approved by the Engineer and of such size, shape, length and weight as to permit driving the pile in the desired location and to the required depth resistance. The follower shall be provided with a socket or hood carefully fitted to the top of the pile to minimize loss of energy and to prevent damage to the pile, and shall have sufficient rigidity to prevent "whip" during driving. Where followers are to be used, the applicable load test piles shall be driven with a similar follower.

### 3.02 INSTALLATION

#### A. General

Piles shall not be driven until Site grading is completed to immediately below pile cut-off level. Any earth material forced up between the piles during driving or other loose or displaced material shall be removed to the correct elevation and any holes or

voids created shall be filled to the correct elevation with suitable approved material and compacted. Surfaces shall be left clean and solid to receive foundation concrete.

Material displaced during driving shall be removed, where it encroaches on the excavated area of the footing.

The tops of all piles shall be square to the longitudinal axis of the pile.

Piles shall not be driven within a radius of 25 feet of concrete which has been in place for less than 72 hours, without the approval of the Engineer.

Hammer blows shall be delivered in direct axis of pile.

The Contractor shall not drive piles in such a manner that the piles are subjected to excessive or undue abuse that would damage the pile material.

Forcing piles into their proper position by the use of excessive manipulation is prohibited.

The Contractor's driving operations shall not cause a degree of vibration harmful to construction operations.

Piles shall be driven to practical refusal in the underlying bedrock as approved by the Engineer and as follows:

Driving shall be carried out until the pile tip makes contact with rock, then stopped, and the elevation recorded. Driving shall then be continued commencing with a 6-inch height of drop of the ram in the case of a drop hammer, or with controlled blows of one tenth of the maximum energy in the case of a mechanical hammer. After the pile has been subjected to at least five series of twenty blows each series, and no further penetration is visible, the fall or energy shall be increased in steps of 12 inches for a drop hammer, or two tenths of the maximum energy for a mechanical hammer. Driving shall continue with these stepped increases in height of fall or energy with the same series of blows as described above until no further practical penetration is observed.

The Engineer will determine when the height of fall, or the hammer energy can be increased and when the driving is complete for each pile.

The Contractor shall not remove pile driving rig from each pile location without the Engineer's approval.

**B. Redriving**

Piles pushed up by driving or loosened by jetting of adjacent piles or for any other reasons shall be redriven to comply with the requirements of this Section. The Contractor shall check for any change in elevation before cut off.

**C. Jetting**

Jetting shall not be done unless permitted in writing by the Engineer. When jetting is permitted, it shall be carried out in such a manner that the carrying capacity of the piles already in place and the safety of existing adjacent structures will not be impaired. Jetting shall be stopped at least 3 feet above the final expected pile-tip elevation and at least 3 feet above the tip elevation of any pile previously driven within 5 feet of the jet,

except that where piles are to be end bearing on rock, jetting may be carried to the rock surface. Piles shall be carried down the depth of jetting until the required resistance is obtained. If there is evidence that jetting has disturbed the load-bearing capacities of previously installed piles, those piles that have been disturbed shall be restored to conditions meeting the specified requirements by redriving. Redriving, where necessary, shall be instituted after the jetting operations in the area have been completed.

D. Splicing

Splicing shall be permitted when the driven pile is of insufficient length to reach the bedrock or achieve sufficient bearing as determined by the Engineer.

Welding shall meet the requirements of AWS; and shall be performed by qualified and experienced welders. The end of the splice material shall be chamfered at 45° for at least half the width of flange and web. Full butt welding is required.

The Contractor shall splice pile extensions to details specified on approved shop drawings by using butt-welded splices. The Contractor shall ensure that extension is in true alignment with driven pile when splicing. The Contractor shall prepare surfaces to be spliced by cutting and grinding square, to ensure full bearing of spliced parts.

E. Cutting Off Piles

All driven piles shall be cut off neatly and squarely to the specified elevation and plane.

The length of pile above cut-off elevation shall be sufficient to permit the removal of all material damaged during driving.

The Contractor shall remove cut-off lengths from Site on completion of work and shall dispose of cut-off lengths at no additional cost to the Trust.

F. Damaged or Defective Piles

Damaged or defective piles, as determined by the Engineer, shall be removed from the Site.

G. Pile Caps

Steel plate pile caps shall be welded to top of piles as shown, conforming to AWS standards.

PART 4 - MEASUREMENT AND PAYMENT

4.01 SUPPLY OF PILING EQUIPMENT

Payment

Payment for the supply of equipment required for the pile driving operation will be made at the lump sum price stipulated in the Schedule of Prices for Item I-1 which price and payment shall be full compensation for the supply, delivery, maintenance and removal of all equipment required for installing piles; and all other miscellaneous items for which separate payment is not provided under other Items.

4.02 PILE SHOES

A. Measurement

Measurement for pile shoes will be made of the actual number of pile shoes supplied and placed on the pile bottoms as measured in place by the Engineer.

B. Payment

Payment for the quantity determined above will be made at the unit price per pile shoe stipulated in the Schedule of Prices for Item I-2 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to install pile shoes; cleaning pile tips and welding on each pile; and all other miscellaneous items for which separate payment is not provided under other Items.

4.03 SUPPLY OF PILES

A. Measurement

Measurement for the supply of piles will be made of the actual number of 17-foot piles for Item I-3 i) and 20-foot piles for Item I-3 ii) as measured by the Engineer, prior to driving.

B. Payment

Payment for the quantity determined above will be made at the respective unit price per 17-foot pile and 20-foot pile stipulated in the Schedule of Prices for Item I-3 i) and I-3 ii), which price and payment shall be full compensation for all labor, plant, materials and equipment required to supply and deliver 17-foot piles for Item I-3 i) and 20-foot piles for Item I-3 ii) to the Site; and all other miscellaneous items for which separate payment is not provided under other Items.

4.04 DRIVING PILES

A. Measurement

Measurement for driving piles will be made in lineal feet for the actual length of steel pile material remaining in the Works, following cut off and removal of the pile tops as measured in place by the Engineer.

B. Payment

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-4 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment for driving of piles; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.05 PILE CUT OFFS

##### A. Measurement

Measurement for pile cut offs will be made of the actual number of piles cut off as measured in place by the Engineer.

No measurement or payment will be made for piles cut off to correct buckling or other damage to the pile tops due to driving, prior to splicing.

##### B. Payment

Payment for the quantity determined above will be made at the unit price per pile cut off stipulated in the Schedule of Prices for Item I-5 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment for cutting off piles; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.06 PILE CAPS

##### A. Measurement

Measurement for pile caps will be made of the actual number of pile caps supplied and placed in the work as measured in place by the Engineer.

##### B. Payment

Payment for the quantity determined above will be made at the unit price per pile cap stipulated in the Schedule of Prices for Item I-6 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for installation of pile caps; supply of pile caps and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.07 SPLICING PILES

##### A. Measurement

Measurement for splicing piles will be made for the actual number of splices made, as determined by the Engineer, in the event that the length of pile supplied as specified is insufficient.

##### B. Payment

Payment for the quantity determined above will be made at the unit price per pile splicing stipulated in the Schedule of Prices for Item I-7 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for pile splicing; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 02701 - BURIED PIPING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of underground piping as specified and as shown on the Drawings.

The work includes but is not necessarily limited to the following:

1. supply and installation of 3-inch diameter HDPE forcemain piping;
2. supply and installation of 6-inch diameter HDPE drain pipe;
3. supply and installation of 2-inch diameter PVC electrical and control conduits including warning tape;
4. supply and installation of 12-inch diameter HDPE culvert;
5. excavation and backfilling for installation of buried piping;
6. hydrostatic and leakage testing of buried forcemain piping; and
7. all other activities required to complete the underground piping.

##### B. Related Work Specified in Other Sections

The following items of work related to work of this Section are specified in other sections as noted:

- |                          |               |
|--------------------------|---------------|
| 1. Earthworks            | Section 02220 |
| 2. Electrical components | Section 16050 |

##### C. Terminology

Piping shall mean HDPE pipe, fittings and appurtenances.

Fittings shall include elbows, tees, couplings, flanges, reducers, caps, adaptors.

#### 1.02 QUALITY ASSURANCE

##### A. General

The Contractor shall comply with Section 01300.

##### B. Certificates

The Contractor shall submit manufacturer's certification of all materials to be furnished prior to their delivery to the Site, certifying conformance to this Project Specification.

C. Installation Instructions

The Contractor shall submit manufacturer's data sheets and installation instructions including butt fusing methods.

1.03 PRODUCT DELIVERY AND HANDLING

A. Delivery

The Contractor shall deliver, store and handle pipe in accordance with applicable requirements of the specified references, the manufacturer's instructions and as specified herein.

B. Storage and Handling

The Contractor shall use every precaution to prevent damage to the pipe. No metal tools or heavy objects shall be unnecessarily permitted to come in contact with the pipe. Any damage to the pipe from any cause during installation and before final acceptance by the Engineer shall be repaired by the Contractor as directed by the Engineer, at no additional cost to the Trust. Material that, in the opinion of the Engineer, cannot be satisfactorily repaired, shall be removed and replaced at no additional cost to the Trust.

1.04 JOB CONDITIONS

The Contractor shall schedule work to minimize time during which trenches and excavations remain open. The Contractor shall backfill and grade the work area to pregrade elevations prior to excavation for and installation of buried forcemain and electrical conduit piping.

PART 2 - PRODUCTS

2.01 MATERIALS

A. High-Density Polyethylene Pipe (HDPE)

(1) General

High density polyethylene pipe (HDPE) shall comply with ASTM D3350, cell classification PE 355434C.

(2) HDPE Forcemain

Pipe shall be SDR 11.0 (160 psi) complying with ASTM F714.

Joints shall be butt fused in accordance with the manufacturers instructions.

(3) HDPE Culvert Pipe

HDPE culvert pipe shall be corrugated and shall conform to AASHTO M294 and shall be classified as Type S.

B. HDPE Fittings

HDPE fittings shall be same pressure rating as pipe and shall be butt fusion, molded fittings complying with ASTM D3261.

C. PVC Electrical and Control Conduits

PVC electrical and control conduits shall be heavy wall, schedule 40 type for underground use without concrete encasement.

Warning tape shall comply with Section 16050.

D. Pull Boxes

Pull boxes shall be precast prefabricated concrete structure, 18-inch diameter, complete with precast base, cast iron frame and lid, and shall be Model PB-18S-1 as manufactured by Kistner Concrete Product Inc. or equal.

E. Bedding Material

Bedding material for forcemains and PVC conduits shall comply with Section 02220.

Bedding material for culvert pipe shall comply with Section 02270. Bedding material for pull Boxes shall comply with Section 02220.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall clean pipe of accumulated debris and water before installation.

The Contractor shall carefully inspect materials for defects and shall remove defective materials from the Site.

Piping shall be laid to the lines and grades shown on the Drawings.

3.02 INSPECTION

The Contractor shall obtain approval from the Engineer for completed excavation prior to placing bedding material or piping.

3.03 PERFORMANCE

A. Excavation, Trenching and Backfilling

The Contractor shall excavate, trench and backfill in accordance with Section 02220.

B. Granular Bedding

Granular bedding shall be placed to details shown on the Drawings.



The Contractor shall shape bed true to line and grade to provide continuous uniform bearing surface for pipe exterior. Blocks shall not be used when bedding pipe.

The Contractor shall compact the full width of granular bed to at least 95% of maximum dry density as determined in accordance with ASTM D698.

C. High-Density Polyethylene (HDPE) Pipe

HDPE pipe except corrugated pipe larger than 2-inch diameter shall be field fused in strict accordance with the manufacturer's instructions. The Contractor shall use a fusing apparatus and personnel trained in the fusing process as approved by the Engineer.

HDPE corrugated pipe shall be joined with corrugated neoprene gasketed premium couplers in strict accordance with the manufacturer's instructions.

Pipe shall not be laid on frozen bedding, water or when trench conditions are unsuitable.

Upon completion of pipe laying and after the Engineer has inspected work in place, the Contractor shall surround and cover pipes between joints with approved cover material placed to dimensions shown on the Drawings.

The Contractor shall hand place cover material and backfill in uniform layers not exceeding twelve (12) inches in thickness to the elevations shown on the Drawings. The Contractor shall not dump material directly on top of pipe.

Layers shall be placed uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

The Contractor shall compact each layer to at least 95 percent of maximum dry density as determined in accordance with ASTM D698.

3.04 FIELD QUALITY CONTROL

A. General

The Contractor shall provide labor, equipment and materials required to perform hydrostatic and leakage tests herein specified. The Contractor shall notify the Engineer at least 24 hours in advance of all proposed tests. The Contractor shall perform tests in the presence of the Engineer.

The Contractor shall test at one time as much of the piping system as practical and authorized by the Engineer.

Before testing, the Contractor shall bed and cover pipe to prevent movement or snaking of pipe line when test pressure is applied.

Air shall be expelled from piping system by slowly filling system with potable water. The Contractor shall ensure that all air is removed prior to applying tests.

B. HDPE Hydrostatic Pipe Pressure and Leakage Testing

The Contractor shall conduct pressure testing by filling piping system with water after joining is complete, and pipe has been laid in trench with no backfill.

The test procedure consists of two steps: the initial expansion phase and the test period.

In order to accommodate the initial expansion of the pipe under test, sufficient make-up water is added to the system at hourly intervals for three hours to bring piping system to the Test Pressure of 100 psi. It is not necessary to calibrate the make-up water for the initial stretching of the pipe.

After the completion of the initial expansion phase (three hours of pressurizing the system to test pressure of 100 psi), the actual test period will begin. The test period must not exceed three hours. After this test period, a measured amount of make-up water should be added to maintain the piping system at the test pressure of 100 psi for a period of three hours. The amount of make-up water added (during the actual test period only), should not exceed allowance for expansion of 0.25 US gallons per 100 feet of 2-inch diameter pipe at the temperature of 73.4°F. When testing the pipe at temperatures below 73.4°F, the amount of make-up water (0.25 US gallons per 100 feet) should be multiplied by the correction factor as follows:

<i>Testing Temperature (°F)</i>	<i>Correction Factor</i>
36	0.25
41	0.30
50	0.42
59	0.55
68	0.75
73.4	1.00

Under no circumstances should the total time under test exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason within this time period, the test section should be permitted to "relax" for an additional eight hour period prior to starting the next testing sequence.

All joints shall be examined for leakage and any joints showing leakage shall be removed from the pipeline, rejoined and the system retested.

It is the responsibility of the Contractor to ensure that normal safety precautions are observed for exposed piping hydrostatic pressure tests.

The Contractor shall locate and repair defects at no additional cost to the Trust if leakage is greater than the amount specified.

The Contractor shall repeat test until leakage is within specified allowance for full length of line.

### 3.05 ADJUSTMENT AND CLEANING

#### A. Forcemain System

On completion, pipes shall be cleaned by flushing. Flushing shall be supplemented by the use of mechanical equipment as necessary to remove foreign material from the pipe.

The Contractor shall not commence flushing operations until hydrostatic and leakage test is completed satisfactorily.

The Contractor shall notify the Engineer at least 24 hours prior to commencing flushing.

The Contractor shall flush forcemain piping through outlets provided by the Contractor with sufficient flow until foreign materials have been removed and flushed water is clear.

Valves and service connections shall be opened and closed to ensure thorough flushing.

The Contractor shall provide connections and pumps as required for flushing operations.

#### **PART 4 - MEASUREMENT AND PAYMENT**

##### **4.01 3-INCH DIAMETER HDPE BURIED FORCEMAIN PIPING**

###### **A. Measurement**

Measurement for 3-inch diameter HDPE buried forcemain piping will be in lineal feet for the actual number of 3-inch diameter HDPE piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings.

###### **B. Payment**

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item J-1 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trenches; dewatering; supply, place and compact granular bedding material where required; supply and install 3-inch diameter HDPE pipe and fittings; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; backfill and compact trenches; stockpile excess material; performing pressure and leakage tests; final cleaning, flushing and dewatering after completion of all tests; restoration and all other miscellaneous items for which separate payment is not provided under other Items.

##### **4.02 PVC ELECTRICAL AND CONTROL CONDUITS**

###### **A. Measurement**

Measurement for PVC electrical and control conduits will be in lineal feet for the actual number of lineal feet of 4-inch diameter PVC conduit for Item J-2 i) and 2-inch diameter PVC conduit for Item J-2 ii) installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings.

###### **B. Payment**

Payment for the quantity determined above will be made at the respective unit price per lineal foot stipulated in the Schedule of Prices for Item J-2 i) and J-2 ii) which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trenches; dewatering; supply, place and compact granular bedding material; supply and install 4-inch diameter PVC conduit for Item J-2 i), 2-inch diameter PVC conduit for Item J-2 ii) and pull boxes; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; backfill and compact trenches; stockpile excess material; pulling of electrical cables including testing; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.03 HDPE CULVERT

##### A. Measurement

Measurement for HDPE culvert will be made at the actual number of lineal feet of 12-inch diameter HDPE culvert for Item J-3 i) and 24-inch diameter HDPE culvert for Item J-3 ii) installed, as measured in place by the Engineer horizontally along the centerline of the culvert continuous through fittings.

##### B. Payment

Payment for the quantity determined above will be made at the respective unit price per lineal foot stipulated in the Schedule of Prices for Item J-3 i) and J-3 ii) which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate; supply, place and compact granular bedding material where required; supply and install 12-inch diameter HDPE pipe and fittings for Item J-3; 12-inch and 24-inch diameter HDPE pipe and fittings for Item J-3 ii); maintaining line and grade; backfill and compact; stockpile excess material; supply and install rip rap erosion protection; final cleaning; restoration; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.04 6-INCH HDPE DRAIN

##### A. Measurement

Measurement for 6-inch diameter HDPE drain will be in lineal feet for the actual number of lineal feet of 6-inch diameter HDPE piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe.

##### B. Payment

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item J-4 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trench; supply, place and compact granular bedding material where required; supply and install 6-inch diameter HDPE pipe; maintaining line and grade; supplying, place and connection of all pipe fittings and bends; supply and place insulation; backfill and compact trenches; stockpile excess material; final cleaning and flushing after completion of installation; restoration; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 02831 - CHAIN LINK FENCES AND GATES

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of chain link fences and gates as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. supply and installation of new gate for Site entrance; and
2. repair of damaged 60 lineal feet of existing chain link fence.

##### B. Technical Requirements Specified In Other Sections

The following items of work shall be carried out in accordance with the technical requirements of the Sections noted below:

1. Concrete for fence post footings, Section 03300.

#### 1.02 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Product Data

The Contractor shall submit manufacturer's product data prior to installation of the materials.

#### 1.03 PRODUCT DELIVERY AND HANDLING

##### A. Delivery

Chain link fence fabric shall be delivered in firmly tied tight rolls. Each roll shall be tagged clearly indicating class of coating, specified wire size, mesh size, height of fabric, ASTM A392 and ASTM F668 designation and manufacturer's name.

##### B. Storage and Handling

The Contractor shall store and handle materials in accordance with manufacturer's instructions. In the event of damage, the Contractor shall make repairs or replacements approved by the Engineer.

Damaged zinc-coated surfaces shall be repaired in accordance with Section 09900.

#### 1.04 JOB CONDITIONS

##### A. Existing Conditions

The security of the Site shall be maintained by the Contractor during the repairs to the existing fencing and installation of the new gate.

##### B. Storage and Handling

The Contractor shall protect zinc-coated surfaces from damage and shall protect fencing materials from distortion or bending.

##### C. Sequencing and Scheduling

The Contractor shall not commence fence installation until all backfilling in areas adjacent to fencing operations is complete.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

##### A. Concrete

Concrete shall comply with Section 03300.

##### B. Chain Link Fence Fabric

Chain link fabric shall comply with ASTM A392 with a uniform 2-inch mesh pattern formed with 9 gage coated steel wire. All fences shall be 6 feet in height to the top of the fence fabric.

##### C. Posts and Rails

Posts and rails shall be galvanized steel pipe, standard weight complying with ASTM A53 and the following:

1. end, corner and straining posts shall be 3.5 inches outside diameter and 48 inches longer than height of fabric;
2. line posts shall be 2 inches outside diameter and 42 inches longer than height of fabric;
3. top rail shall be 2 inches outside diameter; and
4. bracing bars shall be 2 inches outside diameter.

##### D. Tension

Tension wires shall be single strand, galvanized steel wire, 6 gage.

E. Fasteners

Fasteners shall be single strand, galvanized steel wire conforming to requirements of fence fabric, 6 gage.

F. Tension Bars

Tension bars shall be minimum 1/4 inches x 3/4 inches galvanized steel.

G. Gates

Gate frames and bracing shall comply with ASTM A53, galvanized steel pipe, standard weight. Frames shall be manufactured with nominal 2-inch O.D. pipe (2.72 lbs/ft) and shall be adequately braced with 1 5/8-inch O.D. pipe (2.27 lbs/ft).

Gates shall be fabricated to shapes shown on the Drawings with electrically welded joints and hot dip galvanized after welding.

Fence fabric shall be fastened to gate on outside with twisted selvage at top. Fabric and other components used on gates shall match those of fence and shall be of same quality.

Gates shall be furnished with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate. Gate shall be capable of opening 180 degrees in direction shown on Drawings.

Double gates shall be furnished with chain hook to hold gates open and center rest with drop bolt for closed position.

H. Fittings and Hardware

Fittings and hardware shall be galvanized malleable iron.

Post caps shall provide a waterproof fit and shall fasten securely over exterior of posts to carry top rail. Turnbuckles shall be drop forged.

I. Barbed Wire

Barbed wire shall consist of 3 strands of 12 gage galvanized steel wires twisted with 4 points, 14 gage round barbs spaced not more than 5 inches apart, complying with ASTM A121.

J. Extension Arms

Extension arms shall be galvanized malleable iron with eyes to hold top rails and an outward projection to hold barbed wire overhang. Extension arms shall be provided with equally spaced slots to hold 3 strands of barbed wire spaced 6 inches apart with the topmost barbed wire 12 inches above the fabric. Extension arms shall project from fence at 45 degrees above horizontal.

K. Zinc Coating

Zinc coating shall comply with the following:

1. chain link fence fabric in accordance with ASTM A392, Class 2 except that wire zinc-coated prior to weaving into fabric shall be electrolytically zinc-plated;
2. posts, rails, frames and braces in accordance with ASTM A53 except that the zinc coating shall average no less than 2.0 oz. of zinc per sq. ft. and no single coating shall show less than 1.08 oz. of zinc per sq. ft.;
3. barbed wire in accordance with ASTM A121, Class 1; and
4. other fittings and hardware in accordance with ASTM A153.

L. Field Repair Coating

Field repair coating for galvanized surfaces shall comply with ASTM A780.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

Maximum 2-inch clearance between bottom of fence fabric and ground surface shall be provided, except on soft ground where fabric shall extend below grade to compensate for shifting sand or soil.

The Contractor shall not commence gate installation until Site grading work is complete.

3.02 INSPECTION

The Contractor shall provide the Engineer with 24 hours' notice of intention to commence fencing.

3.03 INSTALLATION

A. Posts

Posts shall be installed along lines shown on the Drawings or as directed by the Engineer.

Post holes shall be excavated to dimensions shown on the Drawings in the line of the fence.

Line posts shall be spaced equidistant at intervals not exceeding 10 feet measured parallel to ground surface grade.

Straining posts shall be spaced at equal intervals not exceeding 80 feet if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 100 feet.



The Contractor shall install posts as follows:

1. additional straining posts adjacent to the gate and at sharp changes in grade;
2. corner post where change in alignment exceeds 20 degrees;
3. end posts at end of fence and at buildings; and
4. gate posts on both sides of gate openings.

**B. Concrete**

The Contractor shall place concrete in accordance with Section 03300 in post holes and embed posts into concrete to depths shown on the Drawings. Concrete shall be extended 2 inches above ground level and shall be sloped to drain away from posts. Posts shall be braced and held in plumb position and true to alignment and elevation until concrete has set.

Fence fabric shall not be installed until concrete has cured a minimum of 7 days.

Gate center rests shall be cast in concrete. Concrete above ground level shall be domed to shed water. Position of center gate rest shall be determined for double gates.

**C. Braces**

The Contractor shall install brace bars between end and gate posts and the nearest line post, placed in the center of the panel and parallel to ground surface. Braces shall be installed on both sides of corner and straining posts in a similar manner.

**D. Top Rail**

Top rail shall be installed between all posts and shall be fastened securely to posts with waterproof caps.

**E. Tension Wire**

The Contractor shall install tension wire at the bottom of all fence fabric. Tension wire shall be stretched tightly and fastened securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

**F. Fabric**

The Contractor shall lay out fence fabric and shall stretch the fabric tightly to the tension recommended by the manufacturer. The fence fabric shall be fastened to the end, corner, gate and straining posts with tension bars secured to the posts with tension bar bands at 14-inch intervals. Knuckled selva shall be installed on the bottom of fabric.

Fabric shall be secured to top rails and bottom tension wire with tie wires at 24-inch intervals and to line posts at 12-inch intervals in a vertical taut position. Tie wires shall be given a minimum of two complete twists.

Rolls of fabric shall be joined by weaving a single picket into the ends of the rolls to form a continuous mesh.

G. Barbed Wire

Barbed wire shall be stretched tightly through slots in extension arms and fastened securely at ends using barbed wire bands.

H. Gates

The Contractor shall install gates in locations shown on the Drawings true to opening and plumb in a closed position.

Gates shall be hung with specified fastenings with 2-inch clearance above finished grade as shown on the Drawings or as specified by the Engineer.

I. Extension Arms

Barbed wire extension arms shall be turned outward away from the fenced area. The Contractor shall use vertical extensions on gates end, and corner posts.

J. Caps

Caps shall be installed on the top of gate posts, gate frame extensions supporting barbed wire, and on any other posts which are not fitted with barbed wire extension arms.

3.04 ADJUSTMENT AND CLEANING

The Contractor shall repair damaged galvanized surfaces in accordance with ASTM A780.

Field repair coating shall be applied to damaged galvanized surfaces at dry film thickness at least equal to specified galvanized coating thicknesses.

PART 4 - MEASUREMENT AND PAYMENT

4.01 CHAIN LINK FENCE AND GATES

Payment for chain link fence and gates will be made at the lump sum price stipulated in the Schedule of Prices for Item K-1 which price and payment shall be full compensation for supply of all labor, materials and equipment required for supply and installation of two new gates complete with all hardware; supply and installation of replacement chain link fence complete with fence posts, bracing, hardware; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 02900 - LANDSCAPING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of landscaping as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. topsoiling of areas to receive vegetative cover;
2. fertilizing, seeding and mulching for areas to receive vegetative cover;
3. restoration of existing grassed areas which have been damaged during the prosecution of the Works; and
4. maintenance of vegetative cover.

#### 1.02 QUALITY ASSURANCE

##### A. General

Package standard products shall be with manufacturer's certified analysis. For other materials, the Contractor shall provide analysis by recognized laboratory made in accordance with established methods wherever applicable or as further specified.

##### B. Supplier-Installer Qualifications

The Contractor shall employ only experienced personnel who are familiar with the required work.

##### C. Tolerances

The Contractor shall construct the topsoil layer to the dimensions, lines and elevations as detailed on the Drawings.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Source of Topsoil

The Contractor shall submit to the Engineer the location of the proposed source of topsoil and test results confirming suitability of topsoil at least 14 days prior to commencing topsoiling activities.

C. Seed Certification

The Contractor shall submit Certificates from seed vendors stating botanical and common name, percentage by weight and percentage of purity, germination, and weed seed for each species at least 14 days prior to commencing seeding and mulching activities.

1.04 PRODUCT DELIVERY AND HANDLING

A. Delivery

Grass seed shall be delivered in original containers showing:

1. analysis of seed mixture;
2. percentage of pure seed;
3. year of production;
4. net weight;
5. date when tagged and location;
6. percentage germination; and
7. name and address of distributor.

Mulch shall be delivered in moisture-proof containers showing manufacturer, content and net weight.

Fertilizer and lime shall be delivered in waterproof bags showing weight, analysis and name of manufacturers.

Topsoil shall be delivered in vehicles free of deleterious materials.

B. Storage and Handling

Materials shall be stored in accordance with manufacturer's instructions and in a manner to prevent damage or deterioration.

Seed which has become wet, mouldy or otherwise damaged in transit or storage shall be removed from the Site.

Seed, fertilizer and lime shall be stored in weatherproof containers.

Equipment and methods of handling material shall be such as to prevent contamination by foreign material, intermixing, segregation and breakage.

Stockpiles of topsoil shall be situated so as not to obstruct natural drainage or cause off-Site environmental damage.

The Contractor shall provide and maintain access to stockpile areas, shall stockpile materials in a manner to prevent segregation and upon completion of the Work shall leave stockpile sites in a tidy, well drained condition, free of standing surface water and stockpiled material.

All stockpiles on the Site shall be in approved locations designated by the Engineer.

## 1.05 JOB CONDITIONS

### A. Environmental Requirements

Material shall not be applied over snow, ice or standing water.

The Contractor shall not apply seed slurry when wind conditions are such that material would be carried beyond designated area or that materials would not be uniformly applied.

### B. Protection

The Contractor shall protect all structures, fences, monitoring wells, piezometers, manholes, access roads, and landscaped areas from drainage during performance of the Works.

### C. Sequencing and Scheduling

The Contractor shall sequence and schedule his activities to ensure permanent vegetative cover shall be accomplished within 10 days after loam soil final cover has been completed.

Fertilizer shall be applied at least one week after application of lime.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Topsoil

Topsoil shall be obtained from an approved off-Site source.

Topsoil shall:

1. be capable of supporting vegetative growth;
2. be friable and loamy, non-swelling compatible material with permeability of  $1 \times 10^{-4}$  cm/sec or less;
3. be free of debris, objectionable weeds and stones;
4. contain no toxic substances that may be harmful to plant growth;
5. have pH in range 6.0 to 7.0;
6. have conductivity less than 0.5 millimhos per centimeter; and
7. have a minimum organic matter content of 2.75 percent (organic matter content may be raised by additives as approved by Engineer).

Imported topsoil shall be obtained from an area free from growth of Quackgrass, Japanese Clover, Horsetail, Morning Glory, and other persistent weed plants. Topsoil shall not be obtained from swampy areas and shall not be infested with seeds of noxious weeds.

Topsoil shall be inspected and approved by the Engineer prior to delivery to the Site.

**B. Fertilizer**

Fertilizers for topsoil enhancement shall be Grade 10-20-20.

Fertilizer for hydraulic seeding shall be complete synthetic, slow release fertilizer with maximum 35 percent water soluble nitrogen. Fertilizer ratio and application rate shall be based on soil analysis and shall be determined by the Contractor and approved by the Engineer.

**C. Lime**

Lime shall be ground agricultural limestone containing minimum 85 percent of total carbonates graded in accordance with the following requirements:

<i>Percent Passing by Weight</i>	<i>Sieve Size</i>
90%	No. 18
50%	No. 120

**D. Grass Seed**

Grass seed shall be obtained from an approved seed house and have germination of 75 percent and minimum purity of 97 percent.

**E. Mulch**

Mulch materials shall be wheat straw free from weeds and all other foreign matters. Mulch shall be used dry.

**F. Water**

Water shall be potable and free of impurities that would inhibit germination.

**2.02 MIXES**

Grass seed mixture and seeding rate for all areas as specified or shown on the Drawings shall be:

1. Kentucky Bluegrass - 80 lb/acre
2. Creeping Red Fescue - 40 lb/acre
3. Perennial Ryegrass - 15 lb/acre
4. Seed Rate - 135 lb/acre

**PART 3 - EXECUTION**

**3.01 PREPARATION**

Immediately prior to placing topsoil, the existing surface shall be scarified to a depth of 1 1/2 inches to provide a good bond with the topsoil.

Unsuitable material and soil contaminated with toxic materials shall be removed and disposed of as directed by the Engineer.

All surfaces shall be graded to eliminate uneven areas and low spots and to ensure positive drainage.

### 3.02 INSPECTION

The Contractor shall obtain approval of surfaces from the Engineer prior to topsoiling and seeding.

### 3.03 INSTALLATION

#### A. Topsoil

Topsoil shall only be applied when it is dry enough to work without damaging the soil structure. A uniform application to the depth required to achieve a 6-inch thick (settled) layer shall be placed. All stones larger than two inches across any axis, other debris and unsuitable material shall be removed.

#### B. Fertilizer and Lime

Limestone and fertilizer shall be applied according to soil test or as follows:

1. Lime: 2 tons per acre
2. Fertilizer: 300 lbs. per acre, 10-20-20 or equivalent

Lime shall be applied at specified rate determined by the Contractor from soil sample tests to ensure that topsoil is within specified pH range.

The Contractor shall mix lime into full depth of topsoil prior to application of fertilizer.

The Contractor shall spread fertilizer uniformly over entire area of topsoil at the specified rate and shall mix fertilizer thoroughly to full depth of topsoil.

#### C. Fine Grading

The Contractor shall fine grade the surface free of humps and hollows to eliminate rough spots and low areas and to ensure positive drainage.

The Contractor shall prepare a loose friable bed by means of cultivation and subsequent raking.

The surface shall be rolled to consolidate topsoil for areas to be seeded leaving surface smooth, uniform, firm against deep foot printing and with a fine loose texture.

#### D. Seeding

The Contractor shall apply seed when winds do not exceed 5 mph using equipment suitable for area involved to the approval of the Engineer.

Quantities of material shall be measured by weight or weight-calibrated volume measurement.

The Contractor shall charge the seeder with water, mulch, seed, fertilizer and mix thoroughly. Fertilizer rate shall be based on soil analysis by the Contractor. Material shall be pulverized where necessary and added slowly into seeder under agitation.

Erosion control agent shall be added into seeder and mixed thoroughly to complete the seeding slurry.

The Contractor shall apply complete seeding slurry at the following rate per acre:

- |                                |              |
|--------------------------------|--------------|
| 1. Seed (mixture as specified) | 135 lbs      |
| 2. Mulch                       | 900 lbs      |
| 3. Erosion Control Agent       | 270 lbs      |
| 4. Water, minimum              | 2600 gallons |

Applications shall be blended into existing, adjacent grass areas to bond new growth to existing, adjacent areas or to previous applications to form uniform surfaces.

E. Maintenance

Soil shall be kept moist during germination period and grassed areas shall be adequately watered until accepted by the Engineer.

Water shall be applied to ensure moisture penetration of three to four inches. Sprinkling shall be controlled to prevent washouts.

Grass shall be cut when it reaches height of 2 1/2 inches and shall be cut to height of 1 1/2 inches. Clippings shall be removed.

Grassed areas shall be maintained free of pests and disease.

Herbicide shall be applied when it will not cause damage to new grass.

Seeded areas shall be fertilized one month after seeding.

Fertilizer shall be spread evenly and watered in well. Fertilizing shall be postponed until next spring if application falls within 4-week period prior to expected end of growing season in locality.

3.04 FIELD QUALITY CONTROL

Areas will be accepted by Engineer provided that:

1. seeded areas are properly established,
2. surface soil is free of eroded, bare or dead spots and 98 percent free of weeds,
3. no surface soil is visible when grass has been cut to height of 1 1/2 inches,
4. seeded areas have been cut at least twice, the last cut being carried out 24 hours prior to acceptance.



Areas seeded in the fall will be accepted in the following spring one month after start of growing season, provided acceptance conditions are fulfilled.

3.05 ADJUSTMENT AND CLEANING

The Contractor shall clean up immediately, soil, mulch or other debris spilled onto pavement or gravel access roads and dispose of deleterious materials.

The Contractor shall take precautions and prevent contamination by seeding slurry of gravel access roads, structures, signs, guardrails, fences, utilities or other surfaces not specified to be landscaped.

Where contamination occurs, the Contractor shall remove seeding slurry to satisfaction of, and by means approved by the Engineer.

PART 4 - MEASUREMENT AND PAYMENT

4.01 LANDSCAPING

A. Measurement

Measurement for landscaping will be made at the actual number of square yards landscaped as measured in place by the Engineer, calculated from the horizontal projection of the area landscaped.

B. Payment

Payment for the quantity determined above will be made at the unit price per square yard stipulated in the Schedule of Prices for Item L-1 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to complete landscaping; supply and installation of 6-inch topsoil layer, supply and installation of lime, fertilizer, erosion control agent, grass seed, water; testing of soils, maintenance of vegetated areas until acceptance; soil erosion and sediment control; dust control; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 03300 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of cast-in-place concrete as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. design, supply, installation and removal of concrete formwork necessary for forming cast-in-place concrete;
2. supply and installation of cast-in-place concrete and reinforcement for foundations for tanks and grade beams;
3. supply and installation of cast-in-place concrete and reinforcement for floor slabs in the treatment building;
4. supply and installation of cast-in-place concrete and reinforcement for spill pad at northeastern corner;
5. supply and installation of cast-in-place concrete for fence and gate posts; and
6. supply and installation of cast-in-place concrete for housekeeping pads and containment walls.

##### B. Terminology

Concrete formwork shall mean formwork and falsework.

Formwork means the molds into which concrete is placed.

Falsework means structural supports and the necessary bracing required for the support of temporary loads during construction.

Concrete reinforcement shall mean bar reinforcement and welded wire fabric.

#### 1.02 QUALITY ASSURANCE

##### A. General

Concrete work shall comply with the requirements of ACI 301, except as specified otherwise.

The Contractor shall use ACI 347 and ACI SP-4 as a further guideline for the design and construction of concrete formwork.

B. Supplier-Installer Qualifications

Concrete shall be obtained from a certified ready-mix supplier approved by the Engineer.

Plant certification shall comply with the National Ready Mixed Concrete Association.

C. Tolerances

Unless specified otherwise, reinforcing steel spacing shall not vary by more than 0.5 inches from dimensions shown on the Drawings.

1.03 SUBMITTALS

A. General

The Contractor shall comply with Section 01300.

B. Test Reports

The Contractor shall submit certified mill test reports for concrete reinforcement as requested by the Engineer.

C. Shop Drawings

Placement of reinforcing shall be detailed where special conditions occur.

The Contractor shall design and detail lap lengths and bar development lengths in accordance with ACI 318.

Each drawing submitted by the Contractor shall bear signature and stamp of qualified professional engineer registered in the State of Ohio.

1.04 PRODUCT DELIVERY AND HANDLING

A. Delivery

Concrete shall be delivered in accordance with ASTM C94 Clause 10 accompanied by batch ticket information in accordance with ASTM C94, Clause 15.

B. Storage and Handling

Reinforcement shall be stored in bundles with identifying tags or markings on racks or sills that will permit easy access for identification and handling and prevent it from becoming coated with any material that would adversely affect the bond.

Individual bar identification shall be maintained after bundles are broken. Reinforcement without rolled-in grade marks or certified mill test reports shall be immediately removed from the Site.

## 1.05 JOB CONDITIONS

### A. Environmental Requirements

#### (1) Cold Weather Requirements

Cold weather requirements shall apply when the air temperature is below 40°F and shall comply with ACI 306.

The Contractor shall obtain approval from the Engineer for proposed equipment and methods before concreting in cold weather.

The Contractor shall use steam at a low pressure or vented-type portable heaters to provide a suitable temperature above 40°F for placing concrete. Heaters shall be blocked up and concrete shall be protected from local concentrations of heat. Salamander type heaters shall not be used.

#### (2) Hot Weather Requirements

Hot weather requirements shall apply when the air temperature is above 78°F and shall comply with ACI 305. The Contractor shall obtain approval from the Engineer for proposed equipment and methods before concreting in hot weather.

### B. Protection

The Contractor shall protect concrete materials before, during and after installation and protect installed work and materials of other Sections.

The Contractor shall prevent mechanical disturbance of concrete immediately after placement and during the specified curing period. The Contractor shall prevent damage to finished concrete.

## PART 2 - PRODUCTS

### 2.01 GENERAL

Concrete materials shall comply with ACI 301 except as specified otherwise.

### 2.02 MATERIALS

#### A. Formwork

Formwork material shall comply with ACI 301, Chapter 4 and shall be suitable to achieve the specified finish requirements. Formwork shall be subject to review by the Engineer. The Contractor shall use new plywood forming material to form concrete surfaces exposed to view.

#### B. Form Ties

Form ties shall be removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 1/2 inch in diameter on concrete surface.

C. Form Coatings or Release Agents

Form coatings or release agents shall not impair or prevent adhesion of required surface treatments and shall be subject to review by the Engineer. When used, the Contractor shall comply with manufacturer's specifications.

D. Reinforcing Steel Bars and Welded Wire Mesh

Bars for reinforcement shall be hot-rolled deformed bars complying with ASTM A615 and shall be Grade 60 unless shown otherwise on the Drawings.

Welded wire mesh shall conform to ASTM A185.

E. Tie Wire

Wire for tying reinforcement shall be 16 gage, black annealed wire complying with ASTM A82.

F. Bar Supports

Bar supports shall be sufficient in number and strength to carry the reinforcement they support and prevent displacement by workers or equipment before and during concreting. Bar supports shall be precast concrete blocks, plastic or wire.

G. Spacers

Side form spacers shall be of a type and material that will not cause blemishes, rust spots, or spalling of the exposed concrete surface.

H. Cement

Cement shall be gray, Portland cement Type I unless otherwise specified and shall be obtained from a single manufacturing source approved by the Engineer.

Portland cement shall comply with ASTM C150.

I. Aggregate

Aggregates shall be normal density, hard, durable, uncoated, uncracked gravel with specific gravity of approximately 2.6. Fine and coarse aggregate shall comply with ASTM C33.

J. Water

Water shall comply with ASTM C94, Clause 4.1.3 except that it shall be free from injurious amounts of oil, acid, alkali, organic matter, sediment or any other deleterious substance.

K. Admixtures

Chemical admixtures shall comply with ASTM C494.

Air entraining admixtures shall comply with ASTM C260 "Darex AEA" (W.R. Grace Co.) or "MB-AE10" (Master Builders).

Calcium chloride shall not be used as an admixture.

L. Grout

Use a non-metallic grout, M-Bed manufactured by Sternson Limited for all grouting applications. Comply with the manufacturer's recommendations with regard to handling, mixing and installation.

M. Other Materials

Other materials shall be selected by the Contractor subject to the Engineer's approval prior to use.

2.03 MIXES

Concrete shall be proportioned in accordance with Option A, ASTM C94. The Contractor shall assume responsibility for concrete mix proportions. At least 90 percent of the design water shall be added at the concrete batch plant. Concrete temperature upon delivery to the Site shall be between 60°F and 80°F.

The following class of concrete shall be used in the Works unless otherwise noted:

Specified Strength	4000 psi
Slump,	2 to 4 inches
Air Content	6% +/- 1% by volume
Size of Coarse Aggregate	3/4 inch, max.
Minimum Cement Content	600 lb/cu.yd.

2.04 FABRICATION

Reinforcement shall be fabricated in accordance with ASTM A615 to shapes shown on the Drawings and within fabricating tolerances specified in CRSI.

The Contractor shall wire fabricated reinforcement together in bundles for delivery containing one size, length and mark. Bundles shall be tagged in accordance with CRSI.

PART 3 - EXECUTION

3.01 PREPARATION

A. General

The Contractor shall verify that correct types and sufficient quantities of bar supports and spacers are delivered in sufficient time to avoid delay in placement of reinforcement.

The Contractor shall examine the drawings and other Sections of the Specification to determine provisions for openings, reglets, chases, embedded parts and other items in the forms.

Facilities, materials and equipment necessary for protection of concrete in place from the effects of hot and/or drying conditions and cold weather conditions as applicable, shall be provided and be on hand prior to start of concrete placement.

B. Bonded Joints

Where concrete is to be placed to previously hardened concrete, and shown to be bonded on the Drawings, surfaces shall be prepared in accordance with the following:

1. hardened concrete surfaces shall be thoroughly cleaned of foreign matter and laitance so as to present a clean sound surface with the coarse aggregate partially exposed. The design and consistency of the first layer shall be of the specified quality but shall contain an excess of mortar and shall be vibrated to achieve maximum bond, and shall have a depth of approximately 12 inches; and
2. bonding agents, when approved by the Engineer, shall be applied in strict accordance with the manufacturer's recommendations.

C. Methods of Placing, Curing and Protection

The Contractor shall obtain approval from the Engineer for methods of conveying, spreading, consolidating, finishing, curing and protecting concrete at least 24 hours prior to placing concrete.

D. Base Preparation

Prior to placing concrete floor slabs and chemical spill pad, the granular base shall be lined and fully compacted as specified in Section 02264, with particular attention taken at all edges.

3.02 INSPECTION

The Contractor shall notify the Engineer at least 24 hours in advance of intention to place concrete.

Concrete shall not be placed until the Engineer has inspected foundations, forms, reinforcing steel, embedded parts, methods of mixing, conveying, spreading, consolidating, finishing, curing and protecting concrete or other work specified or required to ensure the proper execution of the work of this Section.

The Contractor shall notify the Engineer, at least 24 hours in advance of completion of concrete reinforcement placing, to permit time for inspection, final adjustment and review by the Engineer prior to placing concrete.

The Contractor shall notify the Engineer of intention to remove formwork and falsework and shall obtain approval from the Engineer prior to proceeding.

### 3.03 INSTALLATION

#### A. Formwork

##### (1) Construction

The Contractor shall comply with ACI 301, Chapter 4 and as specified herein.

The Contractor shall provide 3/4 x 3/4 inch chamfer on external corners and edges of concrete exposed to view, unless otherwise shown on the Drawings.

Where forms are to be partially filled, the Contractor shall fix wooden strips approved by the Engineer to form reglets to define limits between successive pours.

Forms that cannot be properly cleaned or repaired to meet the requirements of this Section shall be immediately removed from the Site.

The Contractor shall ensure that anchors, inserts, angles, pipes and pipe sleeves and other such items to be set in concrete are properly and adequately secured within the forms.

The Contractor shall construct forms tight fitting to prevent cement migrating out of plastic matrix.

The Contractor shall obtain approval from the Engineer for use of earth forms. The Contractor shall hand trim sides and bottoms and shall remove loose earth from earth forms before placing concrete.

##### (2) Removal of Falsework and Formwork

The Contractor shall comply with ACI 301 and as specified herein.

Falsework and formwork shall be removed only after concrete has attained sufficient strength to prevent damage to corners and edges and the concrete structure adequately supports its own weight and construction loads likely to be imposed.

Removal of concrete formwork shall not occur for 48 hours following placement of concrete, providing the curing requirements of ACI 301 are satisfied.

Notwithstanding the specified minimum times, the Contractor shall be responsible for any damage or injury to the concrete caused by removing forms or falsework prior to the concrete gaining sufficient strength.

#### B. Reinforcement

##### (1) General

Concrete reinforcement shall be installed as shown on the Drawings and in accordance with ACI 301.

Bar support systems and patterns shall comply with ACI 315.

The Contractor shall make only those splices shown on the Drawings and in accordance with ACI 318 Class C.



Reinforcement shall be placed and tied to maintain specified tolerances during installation and placement of concrete.

(2) Obstructions

In the event conduits, piping, inserts, sleeves or other items interfere with reinforcement placing the Contractor shall immediately notify the Engineer and shall obtain approval from the Engineer for adjustments.

The Contractor shall not cut bars to clear obstructions without approval from the Engineer.

(3) Field Bending

The Contractor shall not field bend reinforcement except as authorized by the Engineer.

When field bending is authorized by the Engineer, the Contractor shall bend without heat, applying a slow and steady pressure.

Bars which develop cracks or splits shall be replaced.

C. Cast-In-Place Concrete

(1) General

The Contractor shall place, finish, cure and protect concrete in accordance with ACI 301, except as specified herein.

(2) Curing

Section 12.2.13 of ACI 301 shall be deleted from this Specification. Absorptive mat or fabric specified in Section 12.2.1.2 of ACI 301 shall be applied with generous laps to ensure total coverage. Curing by direct hand sprinkling on concrete will not be a method approved by Engineer.

Curing compounds shall not be used on concrete surfaces to which subsequent concrete, tile, paint or other materials are to be bonded unless otherwise approved by the Engineer.

Curing by continuous sprinkling shall be done in a manner which is not harmful to the finished concrete surface. Initial curing shall be by atomized water spray.

(3) Protection

The Contractor shall protect exposed concrete surfaces from shrinkage cracking whenever the rate of evaporation of surface moisture exceeds the rate of bleeding of the concrete.

(4) Finishing of Unformed Surfaces

Unformed surfaces shall be finished as follows:

1. screed, float and apply steel trowel finish;
2. tool edges and joints; and
3. tolerance shall be 1/4-inch in 10 feet.

Floating shall mean mechanical floating, bull floating or darbying to meet specified tolerance.

(5) Finishing of Formed Surfaces

Formed surfaces shall be finished in accordance with ACI 301, Chapter 9 and as follows:

1. smooth form finish as specified in ACI 301, Chapter 10 for concrete exposed to view; and
2. rough form finish for buried concrete as specified in ACI 301, Chapter 10.

(6) Isolation Joints

The Contractor shall locate and form isolation joints to widths and locations shown on the Drawings.

Joint filler shall be installed in accordance with the manufacturer's instructions.

(7) Control Joints

Concrete curing shall be interrupted for the shortest time and the smallest area practicable, in order to perform the following:

Control joints shall be saw-cut when specified using power-driven abrasive or diamond blades. The proper time for cutting, normally from 6 to 18 hours after placement of the concrete, shall be approved by the Engineer on a placement by placement basis and in any event shall begin as soon as the concrete surface has hardened sufficiently to resist ravelling as the cut is made and before shrinkage cracks form in the concrete.

Joints shall be cut to depths, widths and locations shown on the Drawings and to corresponding marking-out lines approved by the Engineer.

After floating, joints shall be tooled where shown on the Drawings, to a depth of 1 inch or one-quarter the depth of the slab, whichever is greater.

(8) Embedded Items

The Contractor shall accurately set embedded parts in place as indicated on the Drawings and as required for anchoring attachments and supports for the work of other trades, and shall accurately place sleeves for piping conduit and other openings. Embedded parts not shown on the Drawings but which are required for other work shall be shown on the reinforcing setting drawings when these are submitted for approval. Reinforcing steel may be moved a small amount to clear openings and embedded parts, and in any event, the required cover over reinforcement shall be maintained. Bars or wire mesh shall not be displaced or distorted to accommodate embedded parts in placing reinforcement and concrete.

Anchor bolts shall be set from manufacturer's approved drawings using accurate templates and bolts shall be held true during placing and curing of the concrete.

### 3.04 FIELD QUALITY CONTROL

#### A. General

Evaluation of concrete quality will be the responsibility of the Engineer. Field quality control shall comply with ACI 301, Chapter 16.

The Engineer will sample and test delivered concrete and such tests will be at the expense of the Trust except as specified otherwise. Copies of test reports will be supplied to the Contractor on request.

If any concrete materials or concrete work or any construction methods used do not meet the requirements of this Section, the Engineer may reject immediately, affected materials or work, or may carry out additional measures as specified in Section 17.3 of ACI 301 before deciding whether or not to reject such materials or work. Additional measures and repair of any resulting damage to the Works will be at the expense of the Trust, if tested materials or work meet the requirements of this Section of the Specification and shall be at the expense of the Contractor if tested materials or work do not meet requirements of the Specification.

#### B. Sampling Concrete

When concrete is conveyed from delivery equipment to point of deposition, samples will be taken at point of deposition.

#### C. Testing by Engineer

Testing by the Engineer or failure to detect defective work shall not prevent rejection when defect is discovered, nor shall it obligate the Trust for final acceptance.

The following tests will be performed by the Engineer:

1. securing composite samples in accordance with ASTM C172;
2. molding and securing specimens from each sample in accordance with ASTM C31;
3. compressive strength in accordance with ASTM C39 except as follows:
  1. two specimens will be tested at 7 and 28 days, and
  2. one strength test for each 50 cubic yard or fraction thereof of each mix placed in any one day;
4. slump for each strength test in accordance with ASTM C143 except as follows:
  1. slump test will be taken at the beginning of each, the middle of, and the end of a particular mixer/ agitator truck as determined by the Engineer, and
  2. whenever consistency of concrete seems to vary;

5. total air content for each strength test in accordance with ASTM C231 or ASTM C173 as determined by the Engineer;
6. temperature of concrete sample and mixing water for each strength test or as required; and
7. temperature of aggregates, cement, water and the mixture thereof at batch plant as required.

#### PART 4 - MEASUREMENT AND PAYMENT

##### 4.01 CAST-IN-PLACE CONCRETE

###### A. Measurement

Measurement for cast-in-place concrete will be made in cubic yards based on the neat lines shown on the Drawings with no deductions for pipes or inserts.

###### B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item M-1 which price and payment shall be full compensation for the supply and installation of all concrete footings and foundations, treatment building floor, chemical spill pad; housekeeping pads and containment walls; including formwork, reinforcing steel, welded wire mesh; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 05100 - STRUCTURAL STEEL

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of structural steel as specified and as shown on the Drawings.

The Work includes, but is not necessarily limited to design, supply and installation of the following:

1. structural steel columns, beams, frames and supports.
2. open web steel roof joints.
3. crane rail beams.

#### 1.02 QUALITY ASSURANCE

##### A. General

All structural steel work shall conform to the Ohio Basic Building Code.

The Contractor shall use skilled workers thoroughly trained and experienced with the requirements and methods needed for proper performance of the work of this Section.

The Contractor shall qualify welding processes and welding operators in accordance with the American Welding Society standards.

##### B. Welding

Qualification - Operators, equipment, materials and methods employed on the work shall be certified by the American Welding Society (AWS) as confirming to AWS Standards for each application required by the Work. Only firms which meet the requirements of the AWS shall be approved for fabrication of steel for this project. Where welding is required of metals other than standard steel, and requiring special techniques, certification shall include the welding of such metals and using such techniques and verification of welding procedures to the satisfaction of the Engineer. Certification for welding of aluminum shall be to AWS Standards.

Welding Specifications - All structural steel welding shall conform to the requirements of AISC and AWS standards. Welding electrodes shall be low hydrogen E70XX or equal or equivalent automatic shop processes.

### 1.03 SUBMITTALS

#### A. Erection and Fabrication Drawings

The Contractor shall submit erection and fabrication drawings to the Engineer for review in accordance with Section 01300.

Design of the crane rail beams and open web steel roof joints shall be by a qualified professional engineer, licenced in the State of Ohio. Submit design calculations to the Engineer for review. Design calculations and drawings shall bear the signature and seal of the design engineer.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. General

The Contractor shall conform to AISC Standard unless otherwise specified.

#### B. Materials

The Contractor shall use material conforming to the following:

##### 1. Steel

Structural Steel - ASTM A36.

##### 2. Bolts

For connections - either ASTM A 307, ASTM A325 or ASTM A490 bolts as specified or required for combined shear, moment, torsion and prying forces.

Anchor bolts - ASTM A307 for mild steel.

### 2.02 FABRICATION

The Contractor shall fabricate structural steel in accordance with AISC standards.

## PART 3 - EXECUTION

### 3.01 PREPARATION

#### A. Erection

The Contractor shall erect structural steel in accordance with AISC Standards and the Ohio Basic Building Code.

The Contractor shall bolt or weld field connections as indicated on the Contract Drawings.

B. Finishing Systems

The Contractor shall touch-up prime coat paint in field following erection.

Prime and finish paint shall conform to Section 09900.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 05100.

Payment for Structural Steel will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 05120 STEEL DECKING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of design, supply and installation of Steel Decking as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. design of structural members; and
2. supply and installation of steel roof decking for the treatment building.

#### 1.02 QUALITY ASSURANCE

##### A. General

The Contractor shall use skilled workers who are thoroughly trained and experienced with the methods needed for proper performance of the Work in the Section.

##### B. Supplier-Installer Qualifications

The design of the steel decking shall be done by a qualified professional engineer, licenced in the State of Ohio.

##### C. Welding

Welding shall conform to Section 05100, by welders qualified in the State of Ohio.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

The Contractor shall submit design calculations and shop drawings, both signed and sealed by the design engineer.

#### 1.04 PRODUCT DELIVERY AND HANDLING

##### A. Delivery

All materials shall be delivered to the site in a timely fashion as required in order to minimize site storage space.



## PART 2 - PRODUCTS

### 2.01 GENERAL

Products shall conform to the requirements of the Ohio Basic Building Code.

### 2.02 STEEL DECKING

Steel decking shall be as shown on the Drawings, zinc coated steel conforming to ASTM A446 Grade A with a core nominal thickness of 0.036 inch, galvanized to ASTM A525.

Depth of configuration shall be 1 1/2 inch.

### 2.03 DESIGN CRITERIA

The steel decking shall be designed for the loadings specified in the Ohio Basic Building Code.

## PART 3 - EXECUTION

### 3.01 PREPARATION

The Contractor shall place steel deck units in accordance with the manufacturers erection drawings and in sequence and method recommended by the manufacturer.

### 3.02 INSTALLATION

The Contractor shall install steel decking in accordance with the following:

1. Weld to all supporting structural steel as recommended by the manufacturer and as shown on Drawings.
2. Bottom weld all side joint laps at the intervals shown on the Drawings, to provide a fully sized membrane.
3. Curb openings as required for roof penetrations. Openings 6 inch diameter and larger shall be reinforced. Openings 18 inch diameter and larger shall be structurally framed.
4. Touch up all welds with zinc rich paint.

## PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 05120.

Payment for Steel Decking will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 05500 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of design, supply and installation of metal fabrications as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. supply and installation of equipment maintenance stands;
2. supply and installation of pipe bollards;
3. supply and installation of anchor bolts and base plates; and
4. design of connections.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

1. Supply of anchor bolts for building, Section 05100.
2. Steel pipe hangers and supports, Section 15070.

##### C. Technical Requirements Specified In Other Sections

The following items of work shall be carried out in accordance with the technical requirements of the Sections noted below:

1. Surface preparation and shop painting metal fabrication, Section 09900.

##### D. Terminology

Pipe supports shall mean steel pipe support brackets and saddles.

Pipe sleeves shall mean pipe sleeves, excluding pipe sleeves for anchor bolts, and including anchors to concrete.

#### 1.02 QUALITY ASSURANCE

##### A. General

The Contractor shall comply with Ohio Basic Building Code.

The Contractor shall weld in accordance with Section 05100.

**B. Supplier-Installer Qualifications**

Fabricators and erectors shall be certified in accordance with the AISC Manual of Steel Construction.

**1.03 SUBMITTALS**

**A. General**

The Contractor shall comply with Section 01300.

**B. Shop and Erection Drawings**

The Contractor shall submit shop and erection drawings.

Shop drawings shall show materials and fabrication details.

Erection drawings shall show general arrangement of work of this Section and shall identify each member to be erected.

**1.04 JOB CONDITIONS**

**A. Protection**

The Contractor shall protect metal fabrications before, during and after installation and protect installed work and materials of other Sections.

The Contractor shall protect shop painted or galvanized surfaces of metal fabrications from damage and prevent contamination of painted surfaces or surfaces specified to be painted.

The Contractor shall not use metal fabrications to be embedded in concrete as a means of temporary support.

Metal fabrications shall be protected from marking and distortion.

**B. Sequencing and Scheduling**

Metal fabrications shall be delivered in such sequence to limit the need for storage at Site and to permit efficient erection.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

All materials shall be new, free from defects impairing strength, durability or appearance, of best commercial quality for the purposes specified.

The Contractor shall conform to AISC design standards and OBBC.

## 2.02 MATERIALS

### A. Anchor Bolts

Steel for anchor bolts shall comply with ASTM A307.

### B. Base Plates

Steel for base plates shall comply with ASTM A36.

### C. Pipe Bollards

Steel for pipe bollards shall be Schedule 40 complying with ASTM A53.

### D. Bolts

High strength bolts shall comply with ASTM A325; other bolts shall comply with ASTM A307.

### E. Expansion Bolts

Expansion bolts shall be Wej-It concrete anchors as manufactured by Wej-It Expansion Products Inc. The anchor shall be the double wedge expansion type, made of cold drawing steel, having the accredited pull out and shear values as published by Wej-It. Sizes and locations shall be in accordance with the Drawings.

### F. Primer

Primer, where required, shall comply with Section 09900.

### G. Galvanizing

Galvanizing, where required, shall comply with ASTM A153.

## 2.03 DESIGN CRITERIA

The Contractor shall design connections not completely detailed on the Drawings in accordance with the Ohio Basic Building Code. Members have been designed as simply supported unless otherwise specified on the Drawings.

## 2.04 FABRICATION

### A. General

The Contractor shall fabricate metal fabrications in strict accordance with reviewed shop drawings and specified references.

Joints shall be accurately coped or mitered or otherwise fitted in accordance with best current practice. Welds in exposed to view connections shall be neatly ground and finished to match the texture of the material in which they occur.

Connections shall be welded except where shown otherwise on the Drawings.

The Contractor shall fabricate or assemble metal fabrications in the shop unless impractical.

Dimensions of existing work shall be verified before commencing fabrication.

The Contractor shall weld in accordance with Section 05100.

Holes shall be drilled or punched.

**B. Shop Painting**

The Contractor shall prepare surfaces to receive shop paint in accordance with Section 09900.

Surfaces other than those to be galvanized or embedded in concrete shall be shop painted in accordance with Section 09900.

**C. Galvanizing**

Pipe bollards shall be galvanized.

**PART 3 - EXECUTION**

**3.01 PREPARATION**

Installation of metal fabrications shall be coordinated with work of other Sections ensuring proper sequencing and support.

Where metal fabrications are specified to be embedded in concrete, the Contractor shall ensure material is on hand sufficiently in advance of concrete operations.

**3.02 INSPECTION**

Prior to commencement of installation, the Contractor shall inspect work of other Sections, identifying improperly installed connecting parts and notify the Engineer immediately.

**3.03 INSTALLATION**

**A. General**

Connections made in the field shall be bolted unless otherwise shown on the Drawings.

Metal fabrications shall be installed in accordance with reviewed erection drawings.

**B. Touch-Up**

The Contractor shall touch up painted surfaces of bolts, rivets, welds and burned or scratched surfaces at completion of erection with same type of paint and to same thickness as shop coat including cleaning and painting of field connections not previously

painted and damaged or otherwise defective paint and rusted areas in accordance with Section 09900.

Galvanized surfaces shall be repaired in accordance with Section 09900.

C. Embedded Parts in Concrete

The Contractor shall set metal fabrications to be embedded in concrete to conform to dimensions and locations shown on the Drawings and in accordance with reviewed erection drawings.

Embedded parts shall be rigidly secured during concrete operations to ensure proper location as shown on the Drawings.

Any displacement of embedded posts, whether caused by movement of formwork, movement of metal fabrications relative to the formwork or otherwise shall be corrected to their specified location.

Installation of embedded parts shall conform with Section 03300.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 05500.

Payment for metal fabrications will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 07200 - INSULATION

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of insulation as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of insulation for the following:

1. concrete foundations and slabs;
2. panel walls and roof; and
3. buried pipelines.

##### B. Related Work Specified in Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

1. Built-Up Roofing, Section 07510.

#### 1.02 QUALITY ASSURANCE

The Contractor shall employ only skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

#### 1.03 PRODUCT DELIVERY AND HANDLING

The Contractor shall store insulation materials dry in original undamaged containers with manufacturer's labels and seals intact.

Wet or otherwise damaged insulation materials will not be accepted for inclusion in the Works and shall be removed from the Site by the Contractor.

### PART 2 - PRODUCTS

#### 2.01 STYROFOAM

Insulation for foundation walls and concrete slabs shall be two-inch thick Styrofoam H1-60 by Dow Chemical.

Flintstik 230-21 adhesive shall be used on walls and overhead slabs.

Insulation for building roofs shall be two-inch rigid insulation, Dow Roofmate, by Dow Chemical.

2.02 FIBERGLASS

Insulation for building walls shall be AF 110 semi-rigid fiberglass, 3 inch thickness, R 3.5 minimum, friction fit by Owens-Corning Fiberglass.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall examine the areas and conditions under which work of this Section will be performed. Building surfaces to receive insulation shall be dry, clean and free from irregularities and loose or adhering materials, oil, grease, dirt or any substance which could affect the performance or effectiveness of the insulation. The Contractor shall correct conditions detrimental to timely and proper completion of the Works. The Contractor shall not proceed until unsatisfactory conditions are corrected to the satisfaction of the Engineer.

The Contractor shall remove or protect against projections in construction framing which may damage or prevent proper insulation installation.

3.02 INSTALLATION

A. Foundations and Buried Pipes

The Contractor shall use the largest module of insulation possible, in order to reduce the number of joints. Holes and tears shall be patched with the same materials.

Earth and granular base shall be fully compacted and levelled beneath insulation.

The Contractor shall butt insulation boards together and stagger joints to ensure a monolithic thermal barrier. Insulation boards shall be installed level.

B. Building Walls

The Contractor shall not install insulation in any part of the building where protection against inclement weather has not yet been provided, and where the insulation could thereby be wet or damaged, or on frozen ground.

All insulation shall be applied in the thickness to dimensions indicated on the Drawings.

C. Roof Insulation

Insulation shall be installed in accordance with accepted practice and manufacturer's instructions for protected membrane or built up roof system.

The Contractor shall butt edges and stagger joints as per A. above.



PART 4 - MEASUREMENT AND PAYMENT

No separate payment shall be made for the work under Section 07200.

Payment for insulation will be made under Items J-4 and Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 07400 - PREFINISHED METAL CLADDING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of prefinished metal cladding as specified and as shown on the Drawings. The work includes, but is not necessarily limited to, the following areas:

1. exterior siding for the Treatment Building.
2. interior wall steel liner panels.
3. fascia and soffits.

#### 1.02 QUALITY ASSURANCE

The Contractor shall use skilled workers thoroughly experienced in the installation of the specified materials.

The Contractor shall perform work in compliance with the Ohio Basic Building Code.

#### 1.03 SUBMITTALS

The Contractor shall comply with Section 01300.

The Contractor shall provide material samples for Engineer's approval and selection of colors from manufacturers standard colors.

Prior to fabrication, the Contractor shall submit shop drawings detailing material and construction methods for review.

### PART 2 - PRODUCTS

#### 2.01 METAL CLADDING

The Contractor shall use metal cladding as manufactured by Butler or Robertson, prefinished sculptured panels, gage as shown on Drawings.

Zinc coating shall conform with ASTM A446, Grade 'A'.

Interior wall panels shall be prefinished steel liner panels.

2.02 FORMED Z-BAR SUB-GIRTS

Zinc coating shall conform to ASTM A446, Grade 'A'.

2.03 FLASHING AND CLOSURES

The Contractor shall fabricate flashing and closures with the same material, thickness and finish as cladding.

2.04 FASTENERS

Fasteners shall be concealed where possible.

Where exposed, use stainless steel fasteners with matching color nylon head and neoprene washer.

2.05 COLOR

The Engineer will select colors at a later time. The Contractor shall allow for two color scheme.

PART 3 - EXECUTION

3.01 INSTALLATION

The Contractor shall install cladding in accordance with the following:

1. Cut sheeting carefully and accurately.
2. Align cladding true to horizontal and vertical planes.
3. Provide fasteners throughout at 12" centers.
4. Caulk side lips and end laps providing a continuous seal in accordance with manufacturer's recommendations.
5. Provide a final joint with a flush surface and allow for expansion and contraction.
6. Cut and flash all openings and protrusions.
7. Prime and seal joints in the liner sheets to form a complete unbroken vapor barrier.

3.02 CLEANING

The Contractor shall clean the installed cladding using mild detergent and water.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 07400.

Payment for Prefinished Metal Cladding will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 07510 - BUILT-UP ROOFING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of built-up roofing as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of the following:

1. built-up roofing on the treatment building.

#### 1.02 QUALITY ASSURANCE

##### A. General

The Contractor shall construct built-up roofing in accordance with the requirements of the Ohio Building Code.

##### B. Supplier-Installer Qualifications

The Contractor shall employ only skilled roofers who have a minimum five years experience in this type of work.

##### C. Tolerances

The Contractor shall lay vapor retardant, insulation and roof felts smooth, tight and flat.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

The Contractor shall submit drawings for special details not covered by manufacturer's standard details, and as requested by the Engineer.

#### 1.04 PRODUCT DELIVERY AND HANDLING

##### A. Delivery

All materials except gravel shall be delivered to the Site as packaged by the manufacturer.

B. Storage and Handling

Felts, asphalt and insulation shall be stored as recommended by the manufacturers, in a heated weatherproof enclosure at a minimum temperature of 45°F.

The Contractor shall not store gravel on roof ahead of demand. Gravel shall be brought to roof only as it is required for spreading.

1.05 JOB CONDITIONS

A. Environmental Requirements

The Contractor shall not proceed with work under extreme conditions of inclement weather, such as excessive precipitation, extreme cold, high winds, or when such conditions appear imminent. The Contractor shall use only dry materials and apply only during weather that will not introduce moisture into roofing system.

B. Protection

The Contractor shall provide adequate protection for roofing work against damage from weather and other causes. Insulation shall not be left exposed overnight or during rain and snow. The Contractor shall strip mop exposed edges and cover with 8 inches wide felt strip. Felt strip shall be removed at resumption of work.

Surrounding work shall be protected against damage. Where hoisting is necessary, the Contractor shall place tarpaulins to protect walls and locate kettles so that smoke will not discolor buildings.

C. Sequencing and Scheduling

The Contractor shall give timely and accurate instruction to other trades that require flashing or boxing in holes through roof.

The Contractor shall examine Site conditions and take Site measurements for proper fitting of holes, curbs, cants, air conditioning units and plumbing fixtures. Openings and inserts shall be verified with other trades.

1.06 GUARANTEE

Upon completion of the work, the Contractor shall provide a written guarantee covering the built-up roofing for a period of ten years and related sheet metal work for a period of five years from the date of final acceptance of the Works.

PART 2 - PRODUCTS

2.01 GENERAL

All materials shall be new, free from defects impairing strength, durability or appearance, of best commercial quality for the purposes specified.

## 2.02 MATERIALS

### A. Felt

The Contractor shall use best quality No. 15 coal tar saturated felt or asphalt/coal tar impregnated glass fiber mat.

### B. Bitumen

The Contractor shall use dead level asphalt (ASTM D312, Type I) or coal tar bitumen (ASTM D450, Type III)

### C. Adhesives, Primers and Vapor Retardants

The Contractor shall conform to felt manufacturers recommendations.

### D. Gravel

Gravel shall comply with ASTM D1863.

### E. Insulation

Insulation shall be as specified in Section 07200, for roof insulation.

## PART 3 - EXECUTION

### 3.01 PREPARATION

Deck shall be swept completely and free of all dust, dirt and debris. The Contractor shall ensure that deck is firm, straight, dry, smooth and free from frost and all foreign matter prior to commencement of vapor retardant application.

### 3.02 INSPECTION

All work installed under this Section shall be subject to inspection at each stage of the work, including preparation, insulation, vapor retardant and felt layers.

### 3.03 INSTALLATION

The vapor retardant and roof insulation shall be installed in accordance with manufacturer's recommendations.

Roof accessories shall be installed at the same time as installation of roof membrane.

The Contractor shall apply built-up roofing felts and bitumen as per Ohio Building Code and manufacturer's recommendations.

The Contractor shall not apply more insulation than can be covered with roofing on the same day or when threat of rain would leave insulation exposed to water. Water stops shall be installed at the end of each day when work is not completed.

3.04 CLEAN UP AND CLEANING

On a daily basis as the work progresses and upon completion, the Contractor shall promptly clean up and remove from the Site all rubbish and surplus material, resulting from the work of this Section.

The Contractor shall wipe and wash clean welded joints of flashings. Bitumen and other foreign matter shall be removed from metal flashings, then they shall be washed with soap and hot water and left in first class condition.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 07510.

Payment for Built-Up Roofing will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION



## SECTION 07600 - FLASHING AND SHEET METAL

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of flashing and sheetmetal as specified and as shown on the Drawings. The work includes but is not limited to the following:

1. flashing fascia and sheet metal for roof system, wall system and associated mechanical appurtenances such as vents and louvers.
2. Roof scuppers and downspouts.

#### 1.02 QUALITY ASSURANCE

The Contractor shall use skilled workers thoroughly trained and experienced in the methods needed for proper performance of the work in this Section.

The Contractor shall conform with the requirements of "Architectural Sheet Metal Manual" published by the Sheet Metal and Air Conditioning Contractors' National Association.

The Contractor shall install in accordance with manufacturer's recommendations.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Samples

The Contractor shall submit samples of items to be used in construction for the Engineer's review.

##### C. Shop Drawings

The Contractor shall submit shop drawings showing sizes, locations and details of the installation.

#### 1.04 PRODUCT HANDLING

The Contractor shall comply with manufacturer's recommendations.

The Contractor shall protect against damage or staining by associated construction operations.

## **PART 2 - PRODUCTS**

### **2.01 METAL FLASHING**

The Contractor shall use 0.6 mm prefinished galvanized sheet steel to ASTM A526, coating designation G90 commercial, color approved by the Engineer.

### **2.02 FASTENERS**

Fasteners shall be hot dip galvanized

### **2.03 FLUX**

Flux shall as recommended by sheet metal manufacturer.

### **2.04 SOLDER**

Solder shall comply with ASTM B32, 50% Tin and 50% Lead.

### **2.05 SEALANT**

Sealant shall be 'Dymeric' by TREMCO.

### **2.06 METAL FLASHING UNDERLAY**

The Contractor shall use dry sheeting paper to Code requirements.

### **2.07 ROOF SCUPPERS AND DOWN-SPOUTS**

Roof scuppers shall be from same material and finish as exterior siding.

Downspout shall be formed from same material and finish as exterior siding, square profile, 6-inch nominal size with anchor straps and bolts as required.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

#### **A. Surface Conditions**

The Contractor shall examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Works. Do not proceed until unsatisfactory conditions are corrected.

### 3.02 INSTALLATION

#### A. General

The Contractor shall provide sheet metal flashing and fascia in accordance with details on the Drawings.

The Contractor shall provide positive counterflashing around exhaust fans, vents and other projections through the roof and wall surfaces. Exterior and interior shall be flashed to provide neat and finished appearance.

The Contractor shall provide all exterior metal flashing with drips.

#### B. Workmanship

The Contractor shall conform to the following:

1. Form sheet metal accurately and to the dimensions and shapes required, finishing molded and broken surfaces with true, sharp, and straight lines and angles and, where intercepting other members, coping to an accurate fit and soldering securely.
2. Turn exposed edges back 1/2 inch.
3. Form, fabricate, and install sheet metal so as to adequately provide for expansion and contraction in the finished work.
4. Finish watertight and weathertight where so required.
5. Make lock seam flat and true to line, sweating full of solder.
6. Make lock seams and lap seams, when soldered, at least 1/2 inch wide.
7. Where lap seams are not soldered, lap according to pitch, but in no case less than 3 inch.
8. Make flat and lap seams in the direction of flow.
9. Provide suitable watertight expansion joints for runs of more than 40 feet, except where closer spacing is indicated on the Drawings or required for proper installation.
10. Secure metal by means of concealed clips or cleats, without nailing through the exterior metal.
11. Space fasteners at regular intervals.
12. Caulk open sheet metal joints.

#### C. Soldering

The Contractor shall perform soldering in accordance with the following:

1. Thoroughly clean and tin the joint materials prior to soldering.
2. Perform soldering slowly, with a well heated copper, in order to heat the seams thoroughly and to completely fill them with solder.
3. Perform soldering with a heavy soldering copper of blunt design, properly tinned for use.
4. Make exposed soldering on finished surfaces neat, full flowing, and smooth.
5. After soldering, thoroughly wash acid flux with a soda solution.

#### PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 07510.

Payment for Flashing and Sheet-Metal will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 07900- SEALANTS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of sealants as specified and as shown on the Drawings. The work includes, but is not necessarily limited to the following areas:

1. Perimeter of door frames and windows on both sides.
2. Control and expansion joints in concrete and masonry.
3. Junction of pipes and conduits passing through walls and ceilings.
4. Under door thresholds and handrail bottom flanges.
5. Perimeter of louvers, flashings and fans on both sides.
6. Between junctions of building components and materials to seal joints, and where otherwise required to provide a positive barrier against passage of moisture and air.

#### 1.02 QUALITY ASSURANCE

The Contractor shall use skilled workers who are thoroughly trained and experienced in the use of materials specified.

The Contractor shall perform work in accordance with the material manufacturer's recommendations.

### PART 2 - PRODUCTS

#### 2.01 SEALANT COMPOUND

The Contractor shall use Dymeric as manufactured by Tremco.

#### 2.02 JOINT BACKING

The Contractor shall use premoulded round closed cell polystyrene, diameter 25% larger than the joint.

2.03 PRIMER/CLEANER

The Contractor shall use primers and cleaners as recommended by the sealant manufacturer.

2.04 BOND BREAKER

The Contractor shall use bond breaker as recommended by the sealant manufacturer.

2.05 COLOR

The Engineer will choose a color from available standard colors.

2.06 VOID FILLER

The Contractor shall use loose glass fiber.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall clean joints of all materials which will affect bonding and remove all release agents.

3.02 INSTALLATION

The Contractor shall install sealants in accordance with manufacturers recommendations and the following:

1. Maintain minimum temperature 40°F.
2. Maintain maximum temperature 80°F.
3. Prime surfaces.
4. Pack joints tightly with sealant backing set at depth specified. Fill other voids with void filler.
5. Provide the following sealant depths:
  - a. 1/4 inch for joints up to 1/2 inch wide.
  - b. 3/8 inch for joints between 1/2 inch and 3/4 inch wide.
  - c. 3/8 inch to 1/2 inch for joints between 3/4 inch and 1 inch wide.
  - d. Provide depth of joint equal to, but not less than half the width of the joint.

6. Apply a bond breaker where packing is not provided.
7. Apply caulking with a pressure gun fitted with a suitable nozzle. Fill the joint completely with one pass.
8. Finish joints so they are smooth, free from ridges, wrinkles and air pockets and have a slightly concave surface.
9. Prime and seal joints between closures, flashings and liners including joint between wall base and grade beam and joint between top of wall and roof.

#### PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 07900.

Payment for Sealants will be made under Item Q-1 in the Schedule or Prices.

END OF SECTION

## SECTION 08100 - METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of the supply and installation of metal doors and frames as specified and as shown on the Drawings.

#### 1.02 QUALITY ASSURANCE

The Contractor shall use skilled workers who are thoroughly trained and experienced in the use of materials specified.

The Contractor shall fabricate doors and frames in accordance with the Steel Door Institute and shall meet the requirements of SDI 100, 117 and 118.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Shop Drawings

The Contractor shall submit shop drawings of hollow metal doors and frames substantiating compliance with the specifications.

The Contractor shall proceed with fabrication only when drawings have been reviewed.

#### 1.04 PRODUCT HANDLING

Store and protect doors and frames to ensure that no bending, warping or marring takes place.

### PART 2 - PRODUCTS

#### 2.01 PERSONNEL DOORS, FRAMES AND HARDWARE

Steel doors shall be of the flush type with provision for cutouts where specified.

Hollow metal doors and frames shall be sized as specified on the Drawings.

Door thickness shall be 2 inches unless specified otherwise.



The type of steel, gauge and manufacturing style shall consist of wipe coated galvanized steel (designation WC) and shall comply with ASTM A525, class designation ZF001.

Galvanized steel shall be mill phosphatized where specified to be subsequently painted.

The door cores shall consist of vertical stiffening with steel ribs and voids filled with semi-rigid fibrous insulation, minimum density. Insulation shall be securely bonded to the inside face of both surface sheets. Vertical stiffeners shall be spot welded to face sheets at maximum 6-inch centers.

The frames shall be sawn or mechanically mitered and continuously welded on the inside of the profile. Welded joints shall be ground to a smooth, uniform finish.

Steel doors and frames shall be manufactured in accordance with Manufacturing Specification for Steel Doors and Frames, except where specified otherwise.

The Contractor shall grind welded corners and joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

The doors shall be prepared to accept the following hardware as specified in Section 08700.

The Contractor shall ensure that the hollow metal frames are prepared and reinforced to accept the above-noted hardware.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

The Contractor shall install doors and frames as follows:

1. Set frames plumb, true, straight, level, square and at correct elevation. Fit doors and with finish hardware as shown in Section 08700. Install doors and hardware in accordance with hardware templates and manufacturers instruction. Provide 1/16" clearance for doors at head and jamb. Hang doors to remain open in any position. Provide integral neoprene weatherstripping on exterior door frames.
2. Secure anchorages and connections to adjacent construction.
3. Brace frames rigidly in position while building in. Provide spreaders and vertical support. Make allowance for deflection of structure to ensure structural loads are not transmitted to frames.

#### 3.02 ADJUSTMENT AND CLEANING

The Contractor shall adjust and lubricate operable parts for correct function. Adjust weatherstripping and seals.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 08100.

Payment for Metal Doors and Frames will be made under Item Q-1 in the Schedule or Prices.

END OF SECTION

## SECTION 08700 - FINISH HARDWARE

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of the supply and installation of finish hardware as specified and as shown on the Drawings.

##### B. Keying System

The Contractor shall master-key all lock functions to Trust's key system and verify keying system with the Engineer at time of shop drawing approval.

#### 1.02 SUBMITTALS

##### A. General

The Contractor shall comply with Section 03100.

##### B. Shop Drawings

The Contractor shall submit illustrated Hardware Schedule for review.

The Contractor shall order hardware only after drawings have been reviewed by the Engineer.

### PART 2 - PRODUCTS

#### 2.01 HARDWARE

The doors shall be prepared to accept the following hardware:

1. Hinges, provide - 1-1/2 pair per door Stanley FBB168, Hager BB1168t.
2. Lock/latch set, provide 5" backset, C32D finish, stainless steel working and exposed parts by Corbin, Sargent.
3. Door Closers - Provide single doors and active side of double doors with an LCN Smoothee Series 4010 or 4020 for the particular door operation.
4. Door Sweeps, Thresholds and Weatherstripping - Provide heavy duty weatherstripping, commercial grade door sweeps and thresholds to weatherproof all exterior doors. Provide an astragal for the double door set.

The Contractor shall ensure that the hollow metal frames are prepared and reinforced to accept the above-noted hardware.

## 2.02 FABRICATION

Finish shall be Satin Aluminum or brushed stainless steel finish as specified.

Door Closures shall be:

1. Rack and pinion type with back-checking feature and with leak proof shaft packing complete with covers.
2. Finish closures with painted aluminum finish and provide covers to match door finish. Closers by Sargent.

Strikes shall be stainless steel template box strikes with extended lips by lock manufacturer.

Flush bolts shall be stainless steel by Sargent or Corbin.

Door Pulls/Push Plates shall be stainless steel No. 4 finish by Ferrum or Sargent.

Thresholds shall be aluminum.

Kickplates shall be stainless steel No. 4 finish with bevelled edges; 1/8 inch thick x 8 inch high by Sargent or Ferrum.

Cylinder/Dead Bolts shall be stainless steel, heavy duty, 6 pin security locks.

Stops shall be aluminum.

Fasteners shall be stainless steel.

Astragal shall be aluminum.

Panic device shall be stainless steel or aluminum as specified on hardware schedule by Sargent.

Weather stripping shall be as per hardware schedule.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

#### A. Thresholds

Thresholds shall be set into a bed of sealant compound and bolt into lead shields in floor.

#### B Door Closures

The Contractor shall arrange closures to prevent obstruction of doorway and to suit conditions of the job. Do not use corner brackets.

C Hardware

The Contractor shall fix hardware into place in accordance with templates and manufacturer's instructions.

D MOUNTING HEIGHTS

The Contractor shall use the following mounting heights:

- |    |                   |  |
|----|-------------------|--|
| 1. | Locks, latch sets | 38 inches from finished floor to center line of strike.  |
| 2. | Hinges            | Upper edge of top hinge 5 inches below head of frame.<br>Lower edge of bottom hinge 10 inches above finished floor. Space center hinge equal distance between top and bottom hinges. |
| 3. | Panic Set         | 40 inches from finished floor to center line of strike.  |
| 4. | Door Pulls        | 41 inches from finished floor to center line of pull.  |
| 5. | Push Plates       | 48 inches from finished floor to center line of plate.   |

The Contract shall advise Engineer immediately of any height conflicts with other work and obtain instructions before proceeding with the installation.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 08700.

Payment for Finish Hardware will be made under Item Q-1 in the Schedule or Prices.

END OF SECTION

## SECTION 08800 - GLASS AND GLAZING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of glass and glazing as specified and as shown on the Drawings.

The work includes, but is not limited, to the following:

1. Window glass
2. Door glass
3. Mirrors

#### 1.02 QUALITY ASSURANCE

##### A. General

Work shall be performed in strict accordance with material manufacturer's instructions.

The Contractor shall conform to the "Glazing Manual" produced by the Flat Glass Marketing Association, with respect to preparation, handling and installation.

##### B. Supplier-Installer Qualifications

The Contractor shall employ trades skilled and proficient in the use of material specified.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Samples

The Contractor shall submit samples of glass and glazing materials for approval to the Engineer upon request.

#### 1.04 GUARANTEE

The Contractor shall provide manufacturer's warranty for insulated or climate control glass, guaranteeing that if any noticeable obstruction of vision occurs as a result of fogging, condensation, film formation or dust collection between the sheets of glass for a period of ten (10) years following the final acceptance of the work the glass shall be replaced at no additional cost to the Trust, with an additional five (5) year warranty on the glass and

installation. The word replace means that all materials, equipment and labor required for the replacement are included.

The Contractor shall guarantee that mirrors supplied and installed under the Contract shall show no silver deterioration for a period of five (5) years.

## PART 2 - PRODUCTS

### 2.01 GENERAL

All materials shall be new, free from defects impairing strength, durability or appearance, of best commercial quality for the purposes specified.

### 2.02 MATERIALS

#### A. Glass

The Contractor shall use glass quality type 'A' as manufactured by Pilkington Glass Limited, Pittsburg-Corning. Glass as manufactured by Pilkington shall be as follows:

1. Float - conforming to Fed Spec DD-G-45, Type I, Class 1, quality q.3.2;
2. Tempered - conforming to Fed Spec DD-G-1403 and ANSI 297.1;
3. Wire Glass - Type III, Class 1, Kind A Form 1 with pattern M3 wire mesh; and
4. Climate Control Glass - exterior tempered float glass-transparent coated conforming to ANSI, tint - bronze.

#### B. Glazing

Exterior glazing shall be double float or plate glass hermetically sealed edges with 1/4 inch stainless steel spacer.

Interior glazing shall be single glazed float glass.

Glazing Tape shall be Tremco 440.

Glazing Compound shall be Tremco Dymeric.

#### C. Other Materials

Setting blocks, spacers and shims shall be rubber shims as recommended by the manufacturer.

## PART 3 - EXECUTION

### 3.01 PREPARATION

The Contractor shall clean glazing channels, stops and rabbets to receive the glazing materials assuring that surfaces are dry, free from frost, grease, and other deleterious substances which may be detrimental to adhesion of glazing compounds.

### 3.02 INSTALLATION

Installation shall conform to the Ohio Basic Building Code.

Setting blocks shall be located at sills one quarter of the width of the glass in from each end of the glass.

Spacers shall be provided at quarter points.

Glazing tape shall be placed continuously against the fixed stop, avoiding lapping in the corners.

The glass shall be set on the setting blocks and pressed solidly against the tape, assuring contact at every point.

A heel head of sealant shall be applied around the perimeter of the glass, maintaining clearance and a positive bond to the sash and lap onto the unit in direct contact with the sash.

The Contractor shall fill the entire void between the edge of the insulating unit and sash at sill only and 6 inches up each jamb with sealant.

Each glass light shall be marked with a white cross to indicate the presence of glass or use approved flags or tape markers temporarily fastened to frames. These tapes shall be maintained until the glass is cleaned.

The Contractor shall be responsible for replacement of all broken glass installed under this Section until satisfactory completion of the Works.

### PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for work under Section 08800.

Payment for Glass and Glazing will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION



## SECTION 09250 - GYPSUM WALLBOARD

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of gypsum wallboard as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to supply and installation of the following:

1. all metal studs;
2. wood strapping or steel furring straps;
3. other steel supports;
4. gypsum wallboard;
5. casings and corner beads;
6. waterproof gypsum wallboard;
7. taping and finishing of joints; and
8. all other work required to complete installation of the gypsum wallboard.

#### 1.02 QUALITY ASSURANCE

All workers shall be skilled and experienced tradesmen with a minimum of three years experience in the installation of gypsum wallboard and steel stud partitions.

#### 1.03 JOB CONDITIONS

##### A. Environmental Requirements

Areas shall be completely dry with heat installed to maintain a minimum temperature of 55°F both during installation and curing of the work. Metal studs or wood strapping and insulation where called for may be placed without temperature restrictions unless specified otherwise.

##### B. Protection

The Contractor shall protect all pipes, outlets, cables and other work from damage by the work of this Section.

C. Sequencing and Scheduling

The Contractor shall commence work of this Section only after work of all other trades required to be completed has been completed and inspected by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Gypsum Wallboard

Gypsum wallboard shall be waterproof type conforming to ASTM C630 for the ceiling in the bathrooms. All other wallboard shall be standard board meeting ASTM C36.

Tape and joint compound shall conform to ASTM C475.

B. Screws

Screws shall be self drilling, self tapping, case hardened, Philips head drywall screws with corrosion resistant finish. Lengths for single thickness shall be #6 x 1-inch and for double layers #7 x 1 1/2-inch. Screws shall conform to ASTM C954.

C. Furring and Metal Studs

Metal studs shall be 25 gage minimum, galvanized, with knurled flanges 1 1/4-inch wide by 3 5/8-inch with access holes. Partition runners shall be 25 gage also with 1 1/4-inch flanges and bracing channels shall be 18 gage 1 1/2-inch x 3/4-inch cold rolled galvanized steel. Steel studs adjacent to metal door frames shall be doubled and reinforced with 2-inch x 4-inch kiln dried wood studs. Reinforced framing shall be installed across tops of door openings for support of doors and door closers.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall coordinate work with piping, plumbing, electrical, door contractors and all other trades to ensure installation of all service lines, door frames and other required services. Where holes larger than those provided are not adequate for other required services, the Contractor shall enlarge openings as required and reinforce studs for material removed and fasten with two screws. Door frames shall be installed as specified in Section 08100 with frame clips fastened to studs and frame around all existing windows and other openings or projections as required to obtain a neat finished appearance.

3.02 INSTALLATION

A. Metal Stud Partitions

Metal stud partitions shall be installed using 3 5/8-inch deep studs with runners secured to floor and ceilings with concrete nails, toggles bolts or sheet metal screws as appropriate. The Contractor shall provide:

1. double nail studs at all doors with automatic closers and at all wall supported fixtures and equipment or electrical enclosures; and
2. double staggered stud walls for sound insulated walls and for walls incorporating plumbing vent piping.

The Contractor shall butt, not miter, floor runners at intersections and corners. Three studs shall be used at all corners and intermediate wall intersections and corner beads are to be installed at all outside corners. Runner channels shall be installed at heads of all openings and studs, double channels with wood reinforcing are required at all solid wood or hollow metal door openings with automatic closers as specified in the door schedule.

Studs shall be spaced at 16-inch c/c maximum. The Contractor shall brace studs with channels wired or welded to each stud. For partitions over 12-inches in height braces shall be installed evenly spaced at maximum 8-inch on center across full width of partition. Where vent pipe is required in washrooms or other locations, the Contractor shall use double stud wall to allow for piping.

All metal studs or other framing required to support the wallboard, and the finished wallboard, shall be installed within 1/8-inch of dimensional location, flat and plumb within 1/16-inch in 10 ft. and within 1/16-inch in any 12-inch running dimension. Corners, edges and angles shall be accurate and true.

**B. Installation on Concrete or Masonry**

Where Styrofoam SM insulation and drywall is called for on the Drawings, the Contractor shall use galvanized metal interlocking wall strapping for fastening of insulation and anchorage for drywall screws as recommended by Dow. Vapor barrier shall be installed on warm side of insulated wall.

**C. Installation of Wallboard**

Wallboard shall be installed with a minimum number of joints, tightly butted and aligned truly to the studs and other anchorage. Wallboard shall be securely fastened with screws to metal studs, concrete blocks or furring or wood strapping with proper torque to avoid excessive penetration into the wallboard. All joints and screw holes shall be taped, filled and sanded for a perfect uniform finish to the approval of the Engineer.

Joint material shall be premixed material and shall be applied strictly according to manufacturers instructions at a temperature no less or greater than specified for the material. The Contractor shall provide adequate ventilation and curing time prior to adding joint material. At joints with other materials and doors, the Contractor shall install casing beads and seal with caulking. At all exterior doors and window openings the Contractor shall insulate between casing and frames with approved insulating tape.

**PART 4 - MEASUREMENT AND PAYMENT**

No separate measurement and payment will be made for work under Section 09250.

Payment for Gypsum wallboard will be made under Item Q-1 in the Schedule of Prices.

**END OF SECTION**

## SECTION 09310 - CERAMIC TILE

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of ceramic tile as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of ceramic tile at cupboards, bathroom areas, and at any other areas indicated on the Drawings.

#### 1.02 QUALITY ASSURANCE

The completed work shall be free of broken, damaged, or otherwise faulty tile, tile work or accessory materials. Tile shall be clean, without excess grout. Finished surfaces shall be flat, within a tolerance of 1/8-inch per 10 ft.

Faces and joints shall be flush, plumb or level and uniform. Intersections, corners and returns shall be neatly and accurately formed with suitable tiles.

Finished joints shall be completely filled, neatly tooled, uniform in appearance, without voids or cracks and shall be watertight.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Samples

The Contractor shall submit samples of manufacturer's complete range of standard colors for tile and grouting to the Engineer for selection of colors and patterns prior to ordering of tile and grouting.

#### 1.04 PRODUCT DELIVERY AND HANDLING

##### A. Storage and Handling

All packaged materials shall be stored dry in original undamaged containers with manufacturer's labels and seals intact.

## 1.05 JOB CONDITIONS

### A. Environmental Requirements

The Contractor shall maintain air temperature and structural base temperature at ceramic tile installation area between 65°F and 80°F for 48 hours before, during and for 48 hours after installation.

### B. Protection

The Contractor shall ensure that floor drains are installed and that conduit, pipes, electrical boxes and similar items occurring in the tile work are properly capped or covered before commencing work.

### C. Sequencing and Scheduling

As far as possible, all trades except painting shall have completed their work in the areas before the tile is laid.

## PART 2 - PRODUCTS

## 2.01 MATERIALS

### A. Ceramic Wall Tile

Ceramic floor tile shall conform to ANSI A137.1.

Wall tile for the areas specified shall be 4-inch x 4-inch glazed, ceramic tile of a color and pattern to be chosen by the Engineer from samples provided by the Contractor. All edges shall be finished with suitable finish edge tiles matching the 4-inch x 4-inch tiles.

### B. Ceramic Floor Tile

Ceramic wall Tile shall conform to ANSI A137.1.

Ceramic floor tile in specified shower drain areas shall be 2-inch x 2-inch or 1-inch x 1-inch and of a color and pattern to be chosen by the Engineer from samples provided by the Contractor.

### C. Floor Quarry Tile

Floor quarry tiles shall conform to ANSI A137.1 and be of highest quality material of minimum 1/4-inch thickness and shall be of a color and pattern as chosen by the Engineer.

### D. Setting and Grouting Materials

Setting and grouting materials shall conform to Ohio Basic Building, Code Chemset (2 compound) as manufactured by MacNaughton Brooks Ltd., color white.

E. Aggregates

Aggregates for setting and grouting shall be approved, blended silica sand, dry, clean, sharp, and durable. Aggregate shall be well graded within limits required for the work, as recommended by the cement manufacturer.

F. Water

Water shall be clean, potable, free from injurious amounts of oil acid, alkali, organic matter or other deleterious substances.

G. Mortar

The Contractor shall use mortar cement compounds consisting of two components which are packaged in the proper proportions for mixing. The Contractor shall ensure that the contents of both containers are completely emptied and combined. Preparation and mixing of the cement with the aggregate shall be done in strict accordance with the manufacturer's instructions. Proportions shall be as follows:

<i>To 1 part of:</i>	<i>Setting Compound</i>	<i>Grouting Compound</i>
add (by volume) for ceramic tile	2 parts sand	1 1/2 parts sand

The Contractor shall use a watertight mechanical mixer such as Mixal Mixer and keep equipment clean and free from hardened materials. Equipment shall be cleaned after preparing each batch.

H. Extra Materials

A minimum of 12 tiles of each size and color shall be supplied by the Contractor to the Trust after completion of the work.

PART 3 - EXECUTION

3.01 INSPECTION

The Contractor shall inspect the following areas prior to commencing installation:

1. surfaces prepared by other trades which may affect the work of this Section;
2. adjacent parts of the building to ensure surfaces are protected from moisture entry; and
3. floor surfaces for evidence of carbonation, dusting and excessive moisture. Concrete shall be at least 28 days old, straight, level and firm; free from grease, oil, or other materials detrimental to bond. Concrete floors for ceramic tile shall be at a level which permits space for tile thickness and adequate mortar under tile for even bearing where required.

The Contractor shall ensure the following:

1. conditions and surfaces are satisfactory before proceeding; and
2. efflorescence has been removed from concrete and masonry surfaces.

### 3.02 INSTALLATION

The Contractor shall clean surfaces of dust, loose particles, oil, grease and other foreign matter. Concrete and masonry backup shall have been properly cured and completed for a minimum of 28 days.

Membrane curing compounds shall not be applied to concrete backup surfaces.

Concrete backup surfaces shall be finished with a light brooming to produce a suitably textured surface for bonding of tile setting bed. Concrete finishers shall be instructed in the requirements of this Section.

Where a satisfactory surface has not been obtained, the Contractor shall acid-etch the surface to ensure a good bonding surface. Commercial muriatic acid (28%), diluted 2 parts water to 1 part acid shall be used to etch the surface. When the reaction with concrete has ceased the surface shall be rinsed thoroughly using clean potable water, and the surface water shall be removed.

### PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for work under Section 09310.

Payment for Ceramic Tile will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 09512 - ACOUSTICAL TILE CEILINGS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of acoustical tile ceilings as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of the following:

1. suspension system;
2. acoustic ceiling panels; and
3. trim.

#### 1.02 QUALITY ASSURANCE

##### A. Supplier-Installer Qualifications

The Contractor shall employ skilled workers thoroughly trained and experienced in the performance of the work of this Section.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Samples

The Contractor shall submit samples of items to be used for the Engineer's approval prior to incorporation in the Works.

#### 1.04 JOB CONDITIONS

##### A. Environmental Requirements

The Contractor shall maintain uniform minimum temperature of 60°F and humidity of 20 to 40 percent before and during installation.

##### B. Sequencing and Scheduling

The Contractor shall coordinate ceiling work to accommodate components of other Sections to be built into acoustical ceiling components.



## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Acoustical Ceiling Panels

The Contractor shall use Armstrong "Second Look II", 2 foot x 4 foot x 3/4 inch lay-in panels No. 2767a or other ceiling tile styles and colors as specified on the Drawings.

#### B. Suspension System

The Contractor shall use Armstrong "Low Gloss" exposed "T" grid system with recessed fixtures to suit specified ceiling panels.

Finish shall be baked enamel, satin white or flat black as required by the Engineer.

All necessary zinc coated accessories shall be provided for a complete installation.

#### C. Intermediate Support Channel

The Contractor shall use 1.21 channels, 1 1/2 inches. deep with 3/8 inches. flanges for mechanical/electrical component support.

#### D. Extra Materials

The Contractor shall provide the Trust with twelve (12) additional ceiling units of each type, style, texture and color used on the project for maintenance purposes.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

#### A. Suspension System

The Contractor shall install suspension system in accordance with the following requirements:

1. install in accordance with manufacturer's printed directions to produce first class flush finish free of irregularities. Butt joints evenly;
2. space hangers at maximum 4-foot on centers both ways;
3. furr around ducts, beams, etc.;
4. frame around fixtures, grills and openings making as few joints as possible;
5. install metal tees with all edges in alignment and all faces in plane including perimeter angle; and
6. maximum allowable out of horizontal plane in any direction over a 10 foot length to be  $\pm 1/16$ -inch with all tile, electrical and mechanical lay-in fixtures in place. Out of straightness shall not be accumulative in any successive 10 ft. length. Adjust

hanger lengths as required to accommodate any deflections in the ceiling support structure.

B. Acoustic Tile

Acoustic tile shall be installed as follows:

1. provide a symmetrical layout as shown on the Drawings. Adjust as necessary to avoid use of cut widths less than 6 inches wide at room perimeters;
2. keep tiles clean during installation. Use clean gloves during installation. Replace any tiles which are soiled or damaged by the work of other trades. Provide one dozen spare tiles of each type, style, color and texture for future replacement of tiles. Store spare tiles where designated by the Trust;
3. install as per manufacturers instructions and UL listing, include hold down clips where required; and
4. panels shall rest evenly on flanges of support tees. Border panels shall be cut to fit neatly against perimeter angles with even bearing.

C. Electrical/Mechanical Fixtures

Fixtures shall be supported with additional hangers at each corner. Additional hangers shall be placed so as not to interfere with installation of fixtures.

The Contractor shall provide certificate for building/Ohio Edison inspector that adequate additional ceiling support has been provided for lay in light fixtures and lenses.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 09512.

Payment for Acoustical Tile Ceilings will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 09660 - RESILIENT TILE FLOORING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of resilient tile flooring as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to supply and installation of resilient tile flooring in the following areas:

1. entrance and hallway;
2. electrical/control room; and
3. any other areas indicated on the Drawings.

#### 1.02 QUALITY ASSURANCE

The Contractor shall employ skilled workers thoroughly trained and experienced in the work of this Section.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Samples

Prior to ordering materials, the Contractor shall provide samples of materials from manufacturer for selection of color, pattern and texture by the Engineer and shall allow for different colors, patterns and/or textures in different areas.

##### C. Maintenance Data

The Contractor shall provide maintenance data for resilient flooring.

#### 1.04 JOB CONDITIONS

##### A. Environmental Requirements

The Contractor shall maintain air temperature and structural base temperature at flooring installation area above 70°F for 48 hours before, during and for 48 hours after installation.

B. Sequencing and Scheduling

The Contractor shall install materials only after finishing operations, including painting, have been completed and after permanent heating system is operating.

PART 2 - PRODUCTS

2.01 TILE

The Contractor shall use 12-inch x 12-inch x 1/8-inch thick tile as supplied by Armstrong.

The Contractor shall provide all tiles in one area from same lot number, including spare tiles.

2.02 BASE MOLDING

Vinyl cover shall be as manufactured by Armstrong and shall be 4-inches in height.

Color shall be selected by the Engineer.

2.03 ADHESIVE

The Contractor shall use adhesive as recommended by manufacturer.

2.04 WAX

The Contractor shall use wax as recommended by manufacturer.

2.05 EXTRA MATERIALS

The Contractor shall provide the Trust with 12 additional tiles of each color, size and texture used on the project for maintenance purposes.

PART 3 - EXECUTION

3.01 PREPARATION

A. General

The Contractor shall remove dust, dirt, paint, caulking, droppings, grease, oil or other contaminants completely from concrete floors using appropriate methods.

B. Subfloors

The Contractor shall verify that substrate is smooth, level, at required finish elevation, and without more than 1/16-inch in 10 feet variation from level or slopes shown on the Drawings.

Prior to laying materials, the Contractor shall broom clean or vacuum the surfaces to be covered, and shall inspect the subfloors.

C. Priming

Concrete slab primer shall be applied if so recommended by the resilient flooring manufacturer.

Primer shall be applied in accordance with the manufacturer's recommendations as approved by the Engineer.

3.02 INSPECTION

The Contractor shall examine the areas and surface conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. The Contractor shall not proceed until unsatisfactory conditions are corrected.

The Contractor shall verify that moisture content of concrete slabs, building air temperature and relative humidity are within the limits recommended by the manufacturers of the materials used.

3.03 INSTALLATION

A. General

The Contractor shall maintain reference markers, holes and openings that are in place or plainly marked for future cutting by repeating on the finished surface as marked on the subfloor. Chalk or other non-permanent marking device shall be used.

B. Installing Resilient Tiles

The Contractor shall install resilient tiles as follows:

1. place units with adhesive cement in strict compliance with the manufacturer's recommendations and as approved by the Engineer;
2. butt units tightly to vertical surfaces, nosings, edgings, and thresholds;
3. scribe as necessary around obstructions and to produce neat joints;
4. place tiles tightly laid, even, and in straight parallel lines;
5. extend units into toe spaces, door reveals, and in closets and similar spaces;
6. lay units from center marks established with principal walls, discounting minor offsets, so that units at opposite edges of the room are of equal width;
7. adjust as necessary to avoid use of cut widths less than 3/4 inches wide at room perimeters;
8. lay units square to axes of the room or space;

9. match units for color or pattern by using materials from cartons in the same sequence as manufactured and packaged;
10. lay in ashlar pattern with grain in all units running the same direction, unless otherwise directed by the Engineer; and
11. place resilient edge strips tightly butted to units and secured with adhesive, and at all unprotected edges unless otherwise shown.

C. Installing Base

The Contractor shall install base at all perimeter areas and around curbs or other obstructions except where cupboard units are installed.

The Contractor shall use factory-preformed exterior corners and factory-preformed or job-mitered interior corners.

3.04 ADJUSTMENT AND CLEANING

Excess adhesive and other blemishes shall be removed from exposed surfaces, using neutral cleaner recommended by the manufacturer.

Floor shall be waxed in accordance with the manufacturer's recommendations.

New floors shall be protected with 6-mil reinforced polyethylene sheeting after waxing. Anchor polyethylene securely to avoid scuffing of tile due to movement.

The Contractor shall maintain protection of finished flooring until acceptance by the Engineer, and shall clean and rewax the floor if required.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for work under Section 09660.

Payment for Resilient Tile Flooring will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 09880 - PROTECTIVE COATINGS FOR CONCRETE

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and application of protective coatings for concrete as specified and as shown on the Drawings.

#### 1.02 QUALITY ASSURANCE

The Contractor shall perform work under manufacturer's supervision.

#### 1.03 JOB CONDITIONS

The Contractor shall provide dust-free conditions.

The Contractor shall satisfy moisture requirements.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

##### Sealer

The Contractor shall use concrete seal by Huntington Laboratories Limitedr.

##### Thinners

Thinners shall be used as recommended by the manufacturer.

### PART 3 - EXECUTION

#### 3.01 APPLICATION

The Contractor shall perform work as follows:

1. seal interior concrete floors, equipment bases and chemical feed pump bases where other covering or protection is not specified;
2. seal after curing is complete in accordance with manufacturer's instructions.
3. scrub concrete surface twice with a power scrubber equipped with nylon mesh brushes and cleaning compound recommended by the sealer manufacturer;
4. provide a minimum of 2 coats of sealer cutting the first coat 25 percent with thinner. Follow manufacturer's instruction; and

5. provide finish product free of runs, dust and brush marks and with a uniform colored appearance.

**PART 4 - MEASUREMENT AND PAYMENT**

No separate measurement and payment will be made for work under Section 09880.

Payment for Protective Coating for Concrete will be made under Item Q-1 in the Schedule of Prices.

**END OF SECTION**



## SECTION 09900 - PAINTING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and application of paint as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the surface preparation and painting of the following:

1. exposed piping;
2. piping supports and equipment frames;
3. structural steel framing and roof joists;
4. miscellaneous metal; and
5. hollow metal doors and frames.

#### 1.02 QUALITY ASSURANCE

##### A. General

The application of paints to steel surfaces whether in the shop or in the field shall comply with SSPC-PA1, unless paint manufacturer's recommendations are more restrictive, in which case such recommendations shall govern.

The application of paints to surfaces other than steel shall comply with SSPC-PA1 to the extent practical.

Reference to the American Arbitration Association contained in various Steel Structures Painting Council references shall not apply to this Section of the Specification.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Names of Manufacturers

When specific manufacturers have not been named in this Section, at least 14 days prior to commencing painting, the Contractor shall submit names of paint manufacturers proposed for the Works. Color schedules shall be submitted for selection by the Trust. Manufacturers shall not be changed without approval from the Engineer.

C. Manufacturer's Recommendations

Paint manufacturer's recommendations shall be obtained concerning all aspects of use for each type of paint specified or proposed, as the case may be.

At least 14 days prior to commencing painting, the Contractor shall notify the Engineer in writing of any requirements in this Section which are not compatible with paint manufacturer's recommendations.

1.04 PRODUCT DELIVERY AND HANDLING

A. Delivery

Products shall be delivered as specified in SSPC-PA1, Clause 5.1.

B. Storage and Handling

Only approved materials shall be stored at the Site in a well ventilated and heated area approved by the Engineer. Materials shall be stored at a minimum ambient temperature of 50°F.

1.05 JOB CONDITIONS

A. Environmental Requirements

The Contractor shall comply with SSPC-PA1, Clause 6.

B. Protection

The Contractor shall take necessary precautionary measures to prevent fire hazards and spontaneous combustion.

Sufficient drop cloths, shields and protective equipment shall be furnished to prevent spray or dropping from fouling surfaces not specified to be painted including surfaces within storage and preparation area.

Waste, cloths and materials which may constitute a fire hazard shall be placed in closed metals containers and removed daily from the Site.

Electrical plates, surface hardware, fittings and fastenings shall be removed prior to painting operations. Such items shall be carefully stored, cleaned and replaced on completion of work in each area. Solvent shall not be used to clean hardware that will remove permanent lacquer finish on some of these items.

Adjacent properties, landscaping, watercourses and public, including vehicles, shall be protected from any damage due to operations.

Adjacent surfaces not specified to be painted, shall be protected from any damage due to operations and if damaged, clean and restore such surfaces to original condition unless specified otherwise.

Primer, paint or pretreatment shall be applied as soon as practical after surface has been cleaned and prior to surface deterioration.

In the event that rusting occurs after completion of surface preparation, surfaces shall be cleaned again as specified.

The Contractor shall prevent contamination of cleaned surfaces by salts, acids, alkali, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between application of remaining coats of paint. Such contaminants shall be removed from surfaces and apply paint immediately.

Cleaned and freshly painted surfaces shall be protected from dust or other foreign matter.

C. Sequencing and Scheduling

Surface preparation shall be discontinued each day in sufficient time to permit the properly prepared surfaces to be primed before the end of the working day.

PART 2 - PRODUCTS

2.01 GENERAL

A. Paint Systems

In each Paint System paints of same type and paints specified by manufacturers' brand names shall be products of same paint manufacturer.

For each Paint System, paints shall be applied in order listed after surface preparation in definition of Paint System.

Paint shall be supplied from the Glidden Paint Company, Valspar Paint Co., or Pittsburg Industries Limited.

2.02 MATERIALS

Surfaces to be coated with paint systems are as follows:

<u>Surface</u>	<u>System</u>
1. Exposed piping, valves, pumps, structural steel, roof joists, miscellaneous metal, metal doors and frames and equipment	Preparation: SSPC-SP6 Type: Alkyd Finish: Gloss First Coat: 37-77 Chem-Prime Second Coat: 2H Color, High-Build Treme Gloss Third Coat: 2H - Color, High-Build Treme-Gloss

The prime coats specified in the painting systems are in addition to shop applied primers for field painted items.

### 2.03 FABRICATION

Shop painting shall be performed in accordance with SSPC-PA1, Clause 8.

## PART 3 - EXECUTION

### 3.01 PREPARATION

The Contractor shall notify the Engineer 48 hours before commencing painting.

### 3.02 INSPECTION

The Contractor shall inspect surfaces prior to commencing work of this Section and report any defects or deficiencies, in writing, to the Engineer.

Paint shall not be applied until prepared surfaces or previously applied paints have been inspected and approved by the Engineer.

### 3.03 PERFORMANCE

#### A. Surface Preparation

Except where specified otherwise in this Section, surfaces shall be prepared in accordance with paint manufacturer's recommendations. As a minimum requirement in all cases, surfaces shall be dry and free from loose rust, loose mill scale, loose paint, oil, grease, dirt, dust and other foreign matter at time of painting.

Before prime coat is applied, edges of adjacent previously painted surfaces shall be feathered.

#### B. Painting

##### (1) General

Field and shop painting shall be performed in accordance with SSPC-PA1.

##### (2) Piping, Valves and Pumps

The Contractor shall coat with primer to a dry film thickness of 2.0 - 3.5 mil followed by two (2) coats finish to dry film thickness of 1.5 to 3.0 mil per coat.

### 3.04 ADJUSTMENT AND CLEANING

Touch-up and repair of paint defects shall be performed using same surface preparation, paint system and products as specified for adjacent surfaces, except as otherwise specified.

Surfaces previously blast cleaned as specified shall be power wire brush cleaned in accordance with SSPC-SP3.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for the work under Section 09900.

Payment for Painting will be made under Item Q-1 in the Schedule of Prices.

END OF SECTION

## SECTION 10050 - MISCELLANEOUS EQUIPMENT SPECIALTIES

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of miscellaneous equipment specialties as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of the following items:

1. alarm bells and horns;
2. fire extinguishers;
3. paper towel dispensers;
4. tissue dispensers;
5. towel bars;
6. soap dispensers;
7. mirrors;
8. signs and labels;
9. clocks;
10. hose reels;
11. oily rag containers;
12. storage cabinets;
13. lockers;
14. laboratory cupboards;
15. clothes hooks;
16. entrance mats;
17. office furniture;
18. laboratory equipment; and
19. maintenance equipment.

## PART 2 - PRODUCTS

### 2.01 SANITARY ACCESSORIES

Accessories as indicated shall be installed at locations described or where indicated as follows:

1. paper towel dispensers (to be installed in washroom and laboratory) shall be Frost no. 410C;
2. soap dispensers (to be installed in washroom and laboratory at locations) shall be Frost no. 718;
3. towel bar (to be installed adjacent to shower enclosure) shall be Amerock;
4. toilet tissue dispensers (to be installed in washroom) shall be by Twin Cee, Frost;
5. two (2) clothes hangers (to be installed in washroom at location) shall be Amerock Ferrum;
6. two (2) clothes hangers (to be installed in the entrance at location) shall be by Amerock Ferrum;
7. four (4) lockers (to be installed in the locker room) from standard colors shall be:
  1. fabricated from new materials complete with hardware and accessories,
  2. square and true, rigidly framed to prevent warping or distortion during installation or use, with no sharp corners or edges,
  3. dimensions of 12 inches wide by 1 inches deep by 72 inches high,
  4. fabricated from minimum 24 gauge steel with 16 gauge stiffening. Doors to be minimum 20 gauge with latch, rubber silencer bumpers, three tamperproof hinges, recessed handle for padlock and nameplate holder. Door to have louvers top and bottom, and
  5. manufactured from prepainted steel having baked enamel finish. Approved manufacturers are:
    1. General Steel Wares, and
    2. Pedlar People.

### 2.02 SAFETY ACCESSORIES

#### A. Fire Extinguishers

Fire extinguishers shall be installed as indicated on the Drawings, and shall be 10 lb. dry chemical extinguishers for ABC class fires, Sentry as manufactured by Ansul.

Extinguishers shall be UL and FM listed and approved, supplied fully and freshly charged with the date of charging indicated on the card attached to the extinguisher and complete with mounting brackets etc.

Mount sign and label as specified shall be at each fire extinguisher location.

Fire extinguishers shall be mounted in the following locations:

1. one (1) to be located in the maintenance area;
2. one (1) to be located at the office entrance;
3. one (1) to be located at the laboratory entrance; and
4. two (2) to be located in the main process area.

B. Oily Rag Container

The Contractor shall provide one (1) oily waste container by Protectoseal model No. 1401 with a minimum capacity of 5 gallons, and it shall be located in maintenance area as directed by the Engineer.

C. First Aid Kit

First Aid Kit shall be acceptable to the authority having jurisdiction for Industrial Establishments.

The Contractor shall provide one first aid kit to be located in the washroom in a location designated by the Engineer.

First Aid Kit shall be as manufactured by Safeco, 10 unit first aid kit.

D. Safety Signs

The Contractor shall refer to Division 16 and Special Provisions for requirements relating to lamacoid warning labels on electrical equipment and other warning signs for high voltage electricity, and refer to Section 09900 for painting.

Signs shall be as manufactured by W. H. Brady Co., and suitable for interior or exterior mounting as required.

Materials of self sticking vinyl film or fiberglass shall be as required by location and surface.

Minimum size shall be 10 inches x 14 inches unless specified otherwise by Catalog number.

Warning signs shall be provided with wording and in locations as follows:

	<i>Location</i>	<i>Wording</i>	<i>Cat. No.</i>
1.	At all fire extinguishers	FIRE EXTINGUISHER	77409 or 71038
2.	Label all fire extinguishers	USE ON ABC FIRES	95228
3.	At air blower installation	DANGER Automatic Start Equipment CAUTION Hearing Protection Required	73009 47018



		CAUTION Do Not Operate Without Guards	47060
4.	At Air Compressor	DANGER Automatic Start Equipment CAUTION Do Not Operate Without Guards	73009 47060
5.	On Acid Storage Tank	CAUTION Corrosive Materials etc.	45581
6.	On NaOH Tank	CAUTION Corrosive Materials etc.	45581
7.	On biotower	CAUTION Biological Material Hazard	
8.	At first aid kit	SAFETY FIRST First Aid Station	46964 or 47044
9.	At eye wash station	EYE WASH	72700

### 3. Flammable Storage Cabinet

The Contractor shall provide UL approved storage cabinet for flammable materials by Safeco model HW30 to be located in maintenance area.

Exact location shall be as specified by the Engineer.

## 2.03 MISCELLANEOUS ACCESSORIES

### A. Clocks

The Contractor shall provide the following clocks:

1. one (1) analog clock by Edwards, series 2940, 12 inches diameter, surface mount, 12 and 24 hour face, black bezel, for 120V, 60 Hz, power supply in the control room;
2. same as above in locker room and in conference room; and
3. wall outlets and wire as per requirements of Section 16001.

### B. Storage Cabinet

The Contractor shall provide two (2) heavy duty storage cabinets, with double steel doors for storage of spare parts located in the maintenance area.

Cabinets shall be minimum 48 inches wide x 60 inches high x 20 inches deep with adjustable shelves as manufactured by Steelcase, Cole.

Color will be selected from standard colors by the Engineer.

Cabinets shall be placed on 3 inch concrete housekeeping slab.

### C. Laboratory/Sample Storage Cupboards

The Contractor shall provide the following:

1. one (1) heavy duty storage cabinet, with double steel doors; and
2. two (2) heavy duty storage shelves with steel supports and plywood shelves.

D. Bathroom Cabinet

The Contractor shall provide the following:

1. 48 inches x 30 inches white laminate "euro" style vanity with solid oak pulls and hidden hinges on doors and shelves on each side for storage of washroom supplies;
2. full-size, drop-in sink, white in color of cultured marble. Sink by Crane or American Standard;
3. sink shall have built-in overflow drain and removable sink plug on chain;
4. single unit washerless tap shall be by Moen, as per shower control. Shutoff valves shall be provided; and
5. standard quality countertop from standard available colors; color will be selected by Engineer during ceramic tile selection.

E. Shower Enclosure and Accessories

Shower shall be of fiberglass construction. Base and corner walls of angle configuration.

The Contractor shall provide two fixed side panels, with opening door removal by full length piano hinge. Glass clear with white stripping.

Towel bars shall be on each fixed panel (two in total).

Frame finish shall be chrome.

Base size shall be 38 inches x 38 inches measured along corner walls.

Single handle water control shall be by Moen (or similar); same supplier as vanity tap.

The Contractor shall provide low-flow hand-held shower head (less than 2.5 gallons per minute (GPM)).

F. Toilet and Accessories

The Contractor shall provide two toilet sets by Crane or American Standard, in white.

Units shall be sized for less than 2 gallons/flush.

Tanks shall be insulated, to reduce condensation.

The Contractor shall provide stop valves for each toilet to allow isolation from plant water supply.

Toilets shall be by washroom sink manufacturer, and of same series/style.

G. Bathroom Mirror

Bathroom mirror shall be premium quality mirror free of flaws and distortions.

Size 36 inches x 48 inches with finished edge.

Wall mount shall be directed above vanity with mirror hooks into wall anchors.

H. Benchseat

The Contractor shall provide 30 inch benchseat for changing purposes and hardwood slot construction with urethane finish.

I. Office Furniture

The Contractor shall provide office furniture as summarized in Attachment E.

J. Laboratory Equipment

The Contractor shall provide laboratory equipment as summarized in Attachment E.

K. Maintenance

The Contractor shall provide maintenance equipment as summarized in Attachment E.

PART 3 - EXECUTION

3.01 INSTALLATION

The Contractor shall install all equipment of this Section in exact locations as directed by the Engineer.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MISCELLANEOUS EQUIPMENT SPECIALITIES

Payment for the miscellaneous equipment specialties will be made at the lump sum price stipulated in the Schedule of Prices for Item N-1 which price and payment shall be full compensation of supply and installation of miscellaneous equipment specialties; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 11300 - PROCESS EQUIPMENT

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of process equipment as specified and as shown on the Drawings.

##### B. Technical Requirements Specified In Other Sections

The following items of work shall be carried out in accordance with the technical requirements of the Sections noted below:

##### Access Piping

- |                                 |               |
|---------------------------------|---------------|
| 1. Metal Fabrications           | Section 05500 |
| 2. Process Piping               | Section 15070 |
| 3. Electrical                   | Section 16001 |
| 4. Instrumentation and Controls | Section 16900 |

#### 1.02 QUALITY ASSURANCE

##### A. General

The vendor of the equipment shall provide a qualified representative of the manufacturer to oversee the final assembly and start-up of the system. The manufacturer's representative shall be present on Site, at a minimum, for the following activities:

1. during prestartup and debugging of the system;
2. during the trial one week period prior to acceptance of system;
3. as may be required for staff training; and
4. in attendance for the final inspection.

##### B. Training

The vendor of the equipment shall provide training as required to familiarize the operations and maintenance staff of the facility with the system and its operations and maintenance requirements. The Contractor shall ensure that all maintenance and operations manuals have been completed and submitted to the Engineer for review prior to the training session for the Trusts operation staff. The training shall be scheduled to immediately follow the successful completion of the trial period of operation.

### 1.03 SUBMITTALS

#### A. General

The Contractor shall comply with Section 01300.

#### B. Shop Drawings

The Contractor shall provide detail shop drawings of all process equipment for review and approval by the Engineer.

#### C. Electrical Requirements

A precise list of all electrical requirements including wire sizes/types and power characteristics of motors and controls shall be provided by the supplier of the process equipment and shall be included in the Shop Drawings.

#### D. Product Data

The Contractor shall provide manufacturer's product data sheets for all equipment to be utilized in the treatment system for review and approval by the Engineer.

The Contractor shall submit to the Engineer four (4) copies of product data sheets or brochures for requirements requested in the Specifications and as the Engineer may reasonably request where shop drawings shall not be prepared due to standardized manufacture of product.

## PART 2 - PRODUCTS

### 2.01 EQUIPMENT

#### A. Caustic Tank

The caustic tank shall be a 3000-gallon steel flat bottom tank 7 foot x 6 inch outside diameter (OD) 10 foot straight sidewall height (SSH). The tank exterior shall be painted and the interior epoxy coated. The tank shall be fabricated of minimum 1/4 inch thick carbon steel SA-285 Grade C minimum with three 2 inch and two 3 inch flanged nozzles and one 18 inch manway with hinged cover.

#### B. Caustic Metering Pump

The caustic metering pump shall be a Liquid Metronics (LMI) model D741 drive (115 VAC) with 35P wet end 30691 analog converter to meter in 18% NaOH at 165 gallon per day or 6.75 gallon per hour, or equivalent .

#### C. Aeration Blower

The aeration blower shall be a Rotron model DR6D89 regenerative blower with a 5 HP, TEFC, 230/460 VAC, 3 phase motor. This unit shall supply 100 cfm air at 96 inches WG static pressure. Supply complete with inlet filter silencer, exhaust silencer, surge relief valve, check valve, vibration isolators and belt guard.

D. Aeration Transfer Pump

The aeration transfer pump shall be Goulds model 3642 centrifugal pump. The pump size is 1-1/4 x 1 1/2-5 with a 1.5 HP, TEFC, 230/460 VAC, 3500 rpm, 3 phase motor. The pump shall supply 50 gpm at 50 foot total dynamic head.

E. Vapor Phase Carbon Adsorbers

The vapor phase carbon adsorbers shall be an Encotech Model GP-2000, 2000-pound adsorber to treat 100 cfm. The units shall be 4 feet diameter x 7 feet high, and made of carbon steel with a coal tar epoxy interior lining and a Tileclad II epoxy exterior finish. There shall be 4-inch 304SS coupling connections and the units shall have fork lift access capability.

F. Inclined Plate Settler

The inclined plate settler shall be a packaged Lamella Gravity Settler Model 125/55, as manufactured by Parkson Corporation. The unit shall have flash mixer and flocculant addition capabilities with 125 square feet of total projected plate area.

G. Settler Sludge Pump

The settler sludge pump shall be a Wilden Model M-1 air operated diaphragm pump complete with exhaust silencer. The pump shall supply a minimum of 10 gpm at 50 feet total head.

H. Acid Metering Pump

The acid metering pump shall be a Liquid Metronics (LMI) Model D741 drive (115 VAC) with 36S wet end and 30691 analog to digital converter to meter in 32% HCl at 2.375 gallons per hour.

I. Bioreactor Tower, Recirculation Pump and Blowers

Biotower shall be an upflow, fixed film, fully submerged, aerobic reactor manufactured by Lancy (US Filter), 12 feet diameter and 24 feet high with 20,300 gallon capacity. The unit shall be epoxy coated steel and shall include the media and ladder to top with platform for access.

Bioreactor recycle pump shall be Durco Mark III IK 1.5 x 1-6 2RV. The pump shall supply 200 gpm at 50 feet total discharge head using a 3HP, 230/460V, 3 phase, 3600 rpm motor. The pump shall be provided as a package with the Bioreactor Tower.

Two bioreactor blowers shall be universal rotary positive displacement blowers from Roots Dresser model 53RA1-U. The units shall supply 170 cfm air @ 12 psi during normal operation and 282 cfm during the bump cycle using a 15 HP, 460 V, TEFC, 1750 rpm, 3 phase motor. The pumps shall be supplied with inlet filter silencers, outlet silencers, surge relief valves, check valves, vibration isolators and belt guards. The blowers shall be provided as a package with the Bioreactor Tower.

J. Bioreactor Sludge Pump

The bioreactor sludge pump shall be a Wilden model M-2 air operated diaphragm pump. The pump shall supply a minimum of 30 gpm at 50 feet total head.

K. Sand Filter

The sand filter shall be a continuous backwash upflow, single media Dyna Sand filter model DSF-12 as manufactured by Parkson Corporation. The unit shall have 12 sq. ft. of filtration area, with air scour internals and a maximum head loss of 30 inches H<sub>2</sub>O pressure.

L. Surge Tanks #2 and #3

Surge tanks #2 and #3 shall be 1100 gallon and fabricated of high density polyethylene, flat bottom dished top, Nalgene tank model 51109-1100, 64 inch diameter and 93 inch overall height.

M. Transfer Pumps

The transfer pumps shall be Goulds model 3642 centrifugal pumps. Each is sized to be 1 1/4 x 1 1/2 with a 1.5 HP, TEFC, 3500 rpm, 230/460 VAC, 3 phase motor. The pumps shall supply 50 gpm each at 50 foot head.

N. Aqueous Carbon Adsorbers

The aqueous carbon adsorption units shall consist of two 20,000 lb adsorbers, skid mounted for a series operation as manufactured by Encotech Inc. The vessels shall be 10 feet diameter and 10 feet straight sidewall height, rated for 75 psig, and lined ASME code carbon steel tanks. The piping between the units shall be 3 inches schedule 40 carbon steel and have 3 inch stainless steel distributors and shall include piping for carbon exchange.

O. Sludge Tank

The sludge tank shall be a 4200 gallon, model 59309-4200, cross linked polyethylene, cone bottom, dished top, 96 inch diameter tank with 137 inch straight sidewall height and with model 53009-4200 stand as manufactured by Nalgene. The tank shall be 177 inch OAH with stand.

P. Sump Pump

The sump pump shall be a Goulds model XSH07 close coupled self-priming pump, size 1-1/4 inch x 1-1/2 with a 3/4 HP, TEFC, 3,500 rpm, 230/400 VAC, 3 phase motor rated for 5 gpm at 20 foot total discharge head.

Q. Dewatering Unit

The dewatering unit shall be a Drimad Model 6BCA six bag filter dewatering unit as fabricated by ResiTech Inc. The unit shall include a Moyno model 367 sludge pump, polymer storage and mixing and feed pump system, bags, and bag moving trolley.

R. Air Compressor

The Contractor shall supply and install one (1) Quiney air compressor Model QEH-15 air compressor complete with 120-gallon receiver (15 HP), 230 V, 60 Hz, 3 phase motor with 1.15 service factor, air aftercooler and belt guard having a rated capacity of approximately 60 CFM at 100 psi. Compressor shall be horizontally mounted on ASME

120-gallon steel receiver and shall be equipped with air intake filter-silencer, approved belt guard, load free starting device, preset pressure switch for automatic On/Off operation, vibration isolation pads, air outlet valve, pressure gauge, safety valve, automatic condensate drain valve, check valve, manifold and shall include tank registration fee and commissioning of the installation. The unit shall be installed according to manufacturer's instructions and the requirements of Section 16100.

S. Refrigerant Air Dryer

The Contractor shall provide and install one (1) only refrigerant air dryer, thermostatically controlled for intermittent or constant flow, DeVilbiss-Hankison model 8070, 115 V, 60 Hz, single phase, complete with coalescent pre-filter, after-filter and automatic condensate drain blow down valve. The Contractor shall include two spare coalescent filter internal spares kits. Equipment shall have capacity to dry a minimum of 60 CFM of air at 36°F non-condensing temperature. The Contractor shall install unit according to manufacturer's instructions.

The Contractor shall provide four (4) Model R-9680-05 series air regulators, one (1) 0-200 psi range complete with 200 psi gauge, two (2) 0-100 psi range with 100 psi gauge, one (1) 0-30 psi range with 0-30 psi gauge and two instrument cartridge air filters with 20 micron filter elements; and shall supply six (6) spare filter elements.

T. Spare Parts

The Contractor shall provide spare parts as listed in Appendix F.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

Equipment shall be installed at the locations shown on the Drawings.

B. Housekeeping Pads

Equipment shall be installed on 2-inch concrete house keeping pads.

C. Installation Instructions

Equipment shall be installed in accordance with the manufacturers instructions.

PART 4 - MEASUREMENT AND PAYMENT

4.01 PROCESS EQUIPMENT

Payment for the process equipment will be made at the respective lump sum price stipulated in the Schedule of Prices for Item O-1 i) to O-1 ixx) which price and payment shall be full compensation for the supply and installation of all the process equipment, spare parts; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION



## SECTION 11550 - TANKS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of fiberglass reinforced plastic kiln (FRP) tanks as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of the following tanks:

1. chemical storage tanks; and
2. chemical process tanks.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

- |                       |               |
|-----------------------|---------------|
| 1. Metal Fabrications | Section 05500 |
| 2. Painting           | Section 09900 |
| 3. Equipment          | Section 11300 |
| 4. Process Piping     | Section 15070 |

#### 1.02 QUALITY ASSURANCE

##### A. Supplier - Installer Qualifications

The Contractor shall employ skilled workers thoroughly trained and experienced with the requirements and methods needed for proper performance of the Work of this Section.

The manufacturer shall have a minimum of five (5) years of related experience in the fabrication of FRP tanks.

The Contractor shall pay all costs associated with testing required because of changes in materials requested by the Contractor or for retesting of materials or workmanship failing to meet specifications.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

**B. Shop and Erection Drawings**

Certified shop drawings and manufacturers literature shall be submitted to the Engineer for approval. The detail drawings shall show all dimensional data and clearances necessary for installation and shall show details and construction to be used.

Fabricator shall provide shop drawings not less than 3 weeks prior to commencement of fabrication, and shall resubmit corrected drawings if amendments are required.

The Contractor shall not proceed with fabrication until shop drawings have been approved by the Engineer.

**1.04 PRODUCT DELIVERY AND HANDLING**

The Contractor shall provide saddles, padding and hold downs satisfactory to the carrier and designed to prevent damage to the fabricated tank.

The Contractor shall arrange for all necessary permits as required for shipping of the tank to the Site.

**1.05 JOB CONDITIONS**

The Contractor shall coordinate installation of tanks with other subcontractors.

**1.06 GUARANTEE**

Contractor shall guarantee the tank, nozzles and any associated valves and fittings against defects in workmanship and materials for a period of two years after the tanks have been placed in regular service. The Contractor shall make good at his own expense any defects noted during the guarantee period.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

1. The tanks shall be vertical tanks, non-pressure type and located as shown on the Drawings.
2. Usable storage volume of tanks shall be as specified.
3. The operating temperature of interior storage tanks shall be from 32° F to 120° F.
4. Resins and tank construction shall have excellent and proven chemical resistance to any deterioration by the concentration of chemical to be stored over the operating temperature ranges given.
5. Tanks shall be capable of resisting all loads applied during handling or erection of the tank whether lifted with the tank vertical or with the tank horizontal.

6. Tanks shall be located on concrete slabs with possible maximum long term deflection of 1/240th of the span and the bottom of the tank shall be designed to accommodate this long term deflection without affecting the factor of safety normally used in design and without causing structural distress to the tanks.
7. Only experienced manufacturers of FRP storage tanks will be considered for design and fabrication of the chemical storage tanks. Tanks must be of proven design and the manufacturer must provide documentation on resin properties and certification of the chemical resistance of the tank for the chemical to be stored.

## 2.02 MATERIALS

The Contractor shall provide materials which meet the following characteristics according to the ASTM test methods specified:

1. ultimate tensile strength of 15,000 psi minimum according to ASTM D-638;
2. ultimate flexural strength of 20,000 psi minimum according to ASTM D-790; and
3. modulus of elasticity 70,000 psi minimum according to ASTM D-790.

The Contractor shall provide materials or finished product with the following characteristics and properties:

1. linear coefficient of expansion  $15 \times 10^{-6}$  in/in/° F;
2. Poissons ratio of approximately 0.20; and
3. minimum glass content of 25%.

All resins used shall be chemically resistant resins containing light stabilizers such as CoRezyn 112LSN or equal.

Fiberglass reinforcement consisting of a combination of chopped strand mat and woven roving equal to Owens Corning shall be used and treated with a finish compatible with the resin being used.

Alternate materials of construction such as Polyethylene or Stainless Steel with equal chemical resistance and capacity may be offered provided that the manufacturer warrants and supplies documentation that the storage tank is equal to the FRP materials. Provide for the same capacities, operating conditions and outlets as those specified in Part 1 above.

## 2.03 DESIGN CRITERIA

### A. Tank Accessories

The Contractor shall provide the following tank accessories:

1. where specified, an access hatch of minimum 18 inches inside diameter in the top or side of the tank with a translucent access cover, PVC or Viton gasket and locking

bolts. For exterior tanks provide reinforcements and stainless steel fixings for padlocking the manway cover;

2. heavily reinforced fiberglass 125 pound, flanged outlets with full face Viton gaskets and blind flanges as follows to be orientated vertically and in plan as per approved shop drawings; and
3. a minimum of three 304 stainless steel plates with heavy reinforcements and glassed shall be integral with the tank. Hold down plates are to be suitable for anchorage to the slab and also designed as lifting lugs if the tank is lifted in the horizontal position. A minimum of two lifting lugs shall also be provided at the top of the tank. Anchor plates and bolts shall be designed to resist full earthquake and other loads as specified in the BOCA.

B. Chemical Storage Tank

The Contractor shall supply, design, fabricate, supply and install one (1) FRP storage tank with double Nexus liner and an operating volume of 3000 US Gallons suitable for storage of hydrochloric acid having a specific gravity of 1.25 at a maximum temperature of 140°F and a minimum temperature of 34° F, 7 foot x 6 inch diameter and 10 foot side wall height, including, 2 inch vent 24 inch access manway, 2 inch fill connection on side of tank at top, and a 2 inch suction connection at bottom of tank.

C. Chemical Process Tanks

(1) Equalization/Aeration Tank

The equalization/aeration tank shall be a FRP (vinyl ester resin), flat bottom, dished top tank. The tank shall have 8 inch OD and 10 foot SSH with a 3,760 US Gallon capacity. There shall be 1 inch diameter stainless steel aeration pipes internally. Tanks shall include 18 inch diameter side located manway. The Contractor shall provide one 1 inch, four 2 inch, five 3 inch and one 6 inch diameter flanged nozzles generally as per drawings.

(2) Surge Tank #1

Surge Tank #1 shall be a FRP (vinyl ester resin) flat bottom, dished top. The tank shall be 6 feet OD and 10 feet SSH with a 2,000 gallon capacity, a single Nexus Veil liner, 18-inch diameter side located manway. The Contractor shall provide three 2-inch and four 3-inch diameter flanged nozzles generally as per drawings.

(3) Inoculum and Nutrient Tanks

The inoculum tank and the nutrient tank shall be FRP with Atlac 382 inner corrosion barrier, 3 1/2 feet OD and 3 1/2 feet in height, open top, having 250-gallon capacity.

D. Additional Requirements

The tank bottom, walls and domed top shall be constructed of FRP (fiberglass reinforced plastic) and shall conform to ASTM standards. The tank shall be constructed using accepted resins for use in storage of commercial grade chemicals. The Contractor shall provide ultraviolet screening for all tanks.

Filament winding shall conform to ASTM D-3299.

Anchor plates and lifting lugs shall be fabricated from 304 or 304L stainless steel which shall be securely glassed to the finished tank using sufficient glass and resin to resist all loads to be expected during handling, erection and in service.

2.04 FABRICATION

The fabricator and installer shall verify all dimensions for erection clearances prior to fabrication and shipping.

All layers shall contain pigment to produce an opaque panel.

The Contractor shall fabricate according to applicable specifications and approved shop drawings.

PART 3 - EXECUTION

3.01 INSPECTION

The Contractor shall notify the Engineer, one week prior to commencement of fabrication and one week prior to shipment to allow for inspection of the work at the manufacturers shop. The Contractor shall provide casual labor to assist in the inspection.

3.02 INSTALLATION

The Contractor shall provide for off-loading, storage, protection from damage and placing of the tank as specified in the manufacturer's written instructions and as shown on the Drawings.

Tank shall be set on minimum 1/4 inch asphalt saturated fiberglass matting as manufactured by Bakelite Corp. and approved mastic compound shall be used to insure uniform bearing of the tank bottom surface.

The Contractor shall prevent mastic compound from staining or overflowing onto concrete slab.

The Contractor shall verify all clearances for installation of the vessel.

Loose piping shall be installed by the piping contractor as per the requirements of Section 15070. Piping of fills, vents and other connections shall be installed as required by the Drawings.

The Contractor shall paint, color code, label and mark all piping as required by the specification.

### 3.03 FIELD QUALITY CONTROL

Prior to filling the tanks with chemical solution and placing the tanks in service, the tank and piping system shall be leakage tested by filling with potable water for a period of 48 hours. No leakage after correction for temperature and evaporation will be allowed.

## PART 4 - MEASUREMENT AND PAYMENT

### 4.01 CHEMICAL STORAGE TANKS

Payment for chemical storage tank will be made at the respective lump sum price stipulated in the Schedule of Prices for Item P-1 i) and Item P-1 ii) which price and payment shall be full compensation for the design, supply and installation of the tanks including preparation of shop drawings; fabrication; delivery; setting; connection to piping; and all other miscellaneous items for which separate payment is not provided under other Items.

### 4.02 CHEMICAL PROCESS TANKS

Payment for chemical process tanks will be made at the lump sum price stipulated in the Schedule of Prices for Item I-2 i), I-2 ii) and I-2 iii) which price and payment shall be full compensation for the design, supply and installation of the Equilization/Aeration tank and the Surge Tank #1 including: preparation of shop drawings; fabrication; delivery; setting; connection to piping; and all other miscellaneous items for which separate payment is not provided under other Items.

### 4.03 INOCULUM AND NUTRIENT TANKS

No separate payment shall be made for the inoculum tank and nutrient tank.

Payment for the inoculum tank and nutrient tank will be made under Item 0-1, xi) in the Schedule of Prices.

END OF SECTION

## SECTION 13121 - BUILDINGS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of design, supply and erection of buildings as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. fabrication, supply and installation of building structure;
2. watertight sealant around floor openings;
3. vapor barrier/thermal barrier;
4. wall and roofing insulation;
5. interior wall steel liner finishing panels;
6. trim and weatherproof caulking; and
7. door and windows.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

- |                               |               |
|-------------------------------|---------------|
| 1. Structural Steel           | Section 05100 |
| 2. Steel Decking              | Section 05120 |
| 3. Insulation                 | Section 07200 |
| 4. Prefinished Metal Cladding | Section 07400 |
| 5. Built-up Roofing           | Section 07510 |
| 6. Flashing and Sheet Metal   | Section 07600 |
| 7. Sealants                   | Section 07900 |
| 8. Metal Doors and Frames     | Section 08100 |
| 9. Finish Hardware            | Section 08700 |
| 10. Glass and Flashing        | Section 08800 |
| 11. Gypson Wallboard          | Section 09250 |

- |                              |               |
|------------------------------|---------------|
| 12. Ceramic Tile             | Section 09310 |
| 13. Acoustical Tile Ceilings | Section 09512 |
| 14. Resilient Tile Flooring  | Section 09660 |
| 15. Painting                 | Section 09900 |

C. Terminology

Pre-engineered buildings shall mean self-framing buildings designated and constructed by a recognized building manufacturer. Self-framing buildings, comprising shed and gable types, shall mean buildings which transfer their external loads to the foundation via the exterior panels or sheeting.

Primary structural members of the building are the columns and roof joists.

D. Alternatives

The Drawings show a complete design for the main treatment building, and general arrangement only for the attached office and laboratory areas. Alternative arrangements for the design of the main building (such as rigid frames) will be considered by the Trust.

The office and laboratory areas consist of pre-engineered buildings, and shall be fully designed and detailed to the dimensions and loadings shown.

1.02 QUALITY ASSURANCE

A. General

The Contractor shall comply with Ohio Building Code and all other referenced standard specifications.

B. Supplier-Installer Qualifications

Steel welders shall be certified in accordance with AWS D1.1, and qualified to work in the State of Ohio.

1.03 SUBMITTALS

A. General

The Contractor shall comply with Section 01300.

Should the Contractor propose an alternate building system to that shown on the Drawings, a complete submission is required detailing all aspects of the proposed building and the changes required to the foundations and details shown on the Drawings. In this event, each drawing and design calculation sheet submitted shall bear the signature and stamp of a qualified professional engineer registered in the State of Ohio.



1.04 PRODUCT DELIVERY AND HANDLING

A. Delivery

Materials shall be delivered to the Site as required to reduce the need for storage.

Materials delivered to the Site shall bear manufacturer's labels and seals intact.

The Contractor shall comply with all referenced Standard Specifications and manufacturer's instructions and recommendations.

B. Storage and Handling

Materials shall be stored in approved locations on Site, and in a manner to avoid contamination by the existing soil or any deleterious material.

1.05 JOB CONDITIONS

A. Protection

The Contractor shall clean up cuttings, strappings, packaging material and other debris each working day and dispose of in a suitable manner.

Units shall be kept free of temporary construction loads until permanently secured.

Galvanized or other finished surfaces shall be protected from damage.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

A. General

Base plan dimensions will be as shown on the Drawings. Building components shall suit dimensions shown on the Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

Foundations and anchor bolts shall be cleaned of debris or other objectionable material.

3.02 INSPECTION

The Contractor shall inspect foundations prior to commencement of erection. Non-conforming items shall be identified and the Contractor shall notify the Engineer of the same.

The Contractor shall obtain approval from the Engineer prior to commencement of installation.

### 3.03 ADJUSTMENT AND CLEANING

The Contractor shall finish his work as follows:

1. remove sealant smears with recommended solvent;
2. adjust and lubricate doors;
3. adjust weatherstripping and door seals; and
4. leave materials clean.

## PART 4 - MEASUREMENT AND PAYMENT

### 4.01 BUILDINGS

Payment for buildings will be made at the lump sum price stipulated in the Schedule of Prices for Item Q-1, which price and payment shall be full compensation for the supply and installation of the buildings including: structural steel; steel decking; insulation; prefabricated metal cladding; built-up roofing; flashing and sheet metal; sealants; metal doors and frames; finish hardware; glass and glassing; gypsum wall board; ceramic tile; acoustical tile ceilings; resilient tile flooring; painting; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 15070 - PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of piping and equipment as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of the following items:

1. Schedule 40 steel piping;
2. copper piping for water supply lines;
3. floor drain and cleanouts;
4. PVC pipe, vent and connections;
5. emergency eyewash/shower station;
6. washbasins;
7. well pumps;
8. pressure tank;
9. hot water heater; and
10. waste holding tank.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

- |               |               |
|---------------|---------------|
| 1. Electrical | Section 16001 |
|---------------|---------------|

##### C. Technical Requirements Specified In Other Sections

The following items of work shall be carried out in accordance with the technical requirements of the Sections noted below:

- |                       |               |
|-----------------------|---------------|
| 1. Metal Fabrications | Section 05500 |
| 2. Painting           | Section 09900 |

##### D. Terminology

Piping shall mean pipe, fittings and appurtenances.

## 1.02 REFERENCES

The publications listed below form part of this Specification. All piping shall comply with applicable requirements of the latest editions of the following:

1. American Society for Testing and Materials (ASTM);
2. ASME Boiler and Pressure Vessel Code; and
3. Ohio Basic Building Code (OBBC).

## 1.03 QUALITY ASSURANCE

### A. General

Piping shall be installed in accordance with ASME, Sections 8 and 9.

The Contractor shall pressure test all piping prior to placing in service at a minimum of twice the maximum operating pressure.

### B. Supplier-Installer Qualifications

Welding shall be performed by a qualified fabricator.

### C. Testing Agency

The Engineer reserves the right to have welding inspected by spot radiographic inspection.

## 1.04 SUBMITTALS

### A. General

The Contractor shall comply with Section 01300.

### B. Shop Drawings

The Contractor shall submit shop drawings for all equipment in this section and shall include the necessary information in a detailed maintenance manual.

## 1.05 PRODUCT DELIVERY AND HANDLING

### A. Delivery

The Contractor shall deliver and store on Site all materials in a manner satisfactory to the Engineer. All materials shall be inspected jointly with the Engineer for damage in transit.

No defective materials shall be delivered to the Site and material found defective at any time shall be removed immediately and replaced at the Contractor's sole expense.

**B. Storage and Handling**

The Contractor shall be responsible for the proper on-Site storage of equipment and shall ensure that the equipment is protected against damage to the satisfaction of the Engineer. All materials damaged while being stored on Site shall be replaced by the Contractor at no cost to the Trust.

**PART 2 - PRODUCTS**

**2.01 STEEL PIPE AND FITTINGS**

**A. Pipe**

Pipe shall comply with ASTM A53 or ANSI B53.2 and the following:

1. method of manufacture: Buttwelded or seamless;
2. weight: Schedule 40 unless indicated otherwise;
3. finish: Black; and
4. end finish: As required for the condition of the installation.

**B. Fittings**

Fittings shall comply with the following:

1. flanged (125 lb standard);
2. welded (Schedule 40 steel); and
3. threaded (steel pipe less than 2 inch dia.)

**C. Flanges**

Flanges shall comply with ANSI B16.5, 150 psi welding neck, slip-on and shall be flat-faced.

Flange bolts and nuts shall comply with ASTM A307, Grade B, galvanized.

Flange gaskets shall be full-faced, 1/8 inch thick neoprene, as recommended by the flange manufacturer.

**D. Weldolets**

Provide weldolets at the sizes as shown on the drawings for the sampling and monitoring ports.

E. Thread Tape

Thread tape shall be teflon.

F. Protective Coating

Pipe and pipe fitting paint shall be as specified in Section 09900. Prime painting shall be as specified in Section 09900. All final coats shall be as specified in Section 09900.

2.02 COPPER PIPE AND FITTINGS

A. Pipe

Pipe shall be seamless copper tube complying with ASTM B 88 (ANSI H23.1) Type K, hard drawn for underground and Type L, hard drawn for aboveground.

B. Fittings

Wrought Copper and Bronze Solder-Joint Pressure Fittings: ANSI B16.22.

Cast Bronze Fittings for Flared Copper Tubes: ANSI B16.26.

C. Solder Metals

95-5 Tin Antimony, ASTM B 32, Grade 50A.

2.03 EQUIPMENT

A. Submersible Well Pump and Accessories

Pump shall be a A-8B series with 1/2 HP 230V, single phase motor with minimum flow requirement of 7 U.S. GPM @ 120 ft. TDH. Size cable to suit length of service in accordance with motor manufacturing requirements. Maximum allowable voltage drop shall be 3% as calculated.

The Contractor shall provide check valve on discharge pipe above pump.

The Contractor shall provide 1-inch diameter riser, pitless well adapter and service line to treatment building.

The Contractor shall provide pump with low water level cut-off, and lightening protection.

Well pump on/off shall be controlled via water system pressure switch.

B. Pressure Control and Regulation

The Contractor shall provide normally open snap action pressure switch which closes upon decreasing pressure to activate well pump motor starter. Provide Square D switch or equal.

Operating pressure range shall be from 40-60 psig.

The Contractor shall provide one pressure tank with internal rubber bladder by Well-X-Trol or equal. Tank will be rigid to provide a minimum pump cycle time of 1.5 min. under worst case demand rate (approximately 40 gallons total volume). Provide model number and precharge system to 60 psi.

Tank shall be mounted on 3 inch skim slab. Provide tank drain, shutoff valve and bypass.

Pressure switch shall be located in vicinity of pressure tank.

C. Hot Water Heater

The Contractor shall provide electric 40-gallon hot water heater.

Tank shall include pressure relief valve and drain fitting.

D. Slop Sink

The Contractor shall provide 15-gallon capacity PVC sink for disposal of mop water.

Sink shall be for commercial application, and be suitably braced. A residential laundry tub is not acceptable.

The Contractor shall provide commercial grade twin handle tap for the unit. Tap shall be wall mounted above the sink unless sink specially reinforced to accept tap unit.

E. Sanitary Waste Holding Tank

The Contractor shall provide 1,500-gallon holding tank of cylindrical proportions.

Tank shall be suitable for sanitary waste storage, and material and class shall be acceptable to local authority.

Tank shall be suitable for direct burial with a maximum 48 inches of soil cover.

The Contractor shall bury tank with approximately 36 inches of cover, and 4 inches of granular or sand bedding. Backfill shall be approved native material, free of rocks, debris or excessively wet or organic material.

The Contractor shall provide a pump out riser of 12-inch diameter. Riser shall be saddle mounted in the field or fabricated by tank manufacturer prior to delivery and shall extend 12 inches above final grade.

Tank shall be vented through building sanitary water vent system in accordance with OBBC.

F. Emergency Shower/Eyewash Station

Emergency shower/eyewash station shall be equipped with drench shower, eye bath, deluge shower head, stainless steel bowl and shall be stay-open ball valve Model 8301 as manufactured by Haws Emergency equipment, or an approved equivalent.

**2.04 HDPE PIPE AND FITTINGS**

**A. High Density Polyethylene Pipe (HDPE)**

High density polyethylene pipe (HDPE) and fitting material shall conform to the cell classification PE 355434C as defined in ASTM D 3350, and as manufactured by Driscopipe.

**B. HDPE Fittings**

HDPE fittings shall be butt fusion, molded fittings, complying with ASTM D3261.

**C. HDPE Pressure Rating**

HDPE pipe and fittings shall be SDR 11.0 (160 psi), complying with ASTM F714.

**2.05 HANGERS AND SUPPORTS**

The Contractor shall provide pipe supports as detailed and shown on the Drawings. The Contractor shall provide miscellaneous brackets as required between building purlins.

**2.06 PVC PIPE AND FITTINGS**

The Contractor shall provide Schedule 80 PVC pipe and fittings for piping after the biotower.

**2.07 GALVANIZED STEEL PIPE AND FITTINGS**

**A. Pipe**

Pipe shall comply with ASTM A53. Weight: Schedule 40 unless indicated otherwise by the Engineer.

**B. Fittings**

Screwed 3000# galvanized, forged steel, ASTM A105, Grade II. Galvanizing, hot dipped, ASTM A153.

**C. Flanges**

Flanges shall be Class 150, ductile iron threaded, flat face, ASTM A395.

**D. Thread Tape**

Thread tape shall be teflon.



## PART 3 - EXECUTION

### 3.01 INSTALLATION

#### A. General

Installations shall be completed to present a neat orderly appearance.

Openings or passageways shall not be blocked with piping. Minimum clear headroom shall be 12 feet.

Piping shall be run parallel to building walls.

Steel piping shall be kept free from contact with structure or installed items except as noted on the Drawings.

Clearances shall be allowed for expansion and contraction of pipe.

Vertical piping shall be placed as follows:

1. secure at sufficiently close intervals to keep pipe in alignment and to support weight of pipe and contents; and
2. install supports vertically at intervals of not more than 4 feet.

Horizontal piping shall be placed as follows:

1. support at sufficiently close intervals to maintain alignment and prevent sagging;
2. install hangers at ends of runs or branches and at each change of direction or alignment; and
3. support spacing shall not exceed the manufacturer's recommendations, nor as specified below:

<i>Pipe</i>	<i>Maximum Support Spacing (ft)</i>
-------------	-------------------------------------

#### Steel

Under 3/4 inches	4
3/4 inches and over	8

#### PVC

To 3/4 inches	2
1 to 1 1/2 inches	3
2 inches or over	5

The Contractor shall not use equipment to support piping or induce strain on equipment during or subsequent to the installation of piping.

Flexible connections or unions shall be provided at all connections to equipment to facilitate removal for maintenance.

B. Flanged Joints

Flange bolts shall be tightened so that gasket is uniformly compressed and sealed.

Flanges shall not be distorted.

Flange bolts shall be left with ends projecting not more than 1/2 inch nor less than 1/4 inch and no bolt shall be less than the diameter of the hole in which it fits by more than 1/8 inch.

C. Welded Joints

Welded joints shall be shop fabricated to the maximum extent possible.

Damage to protective coatings shall be repaired to a condition equivalent to the factory or shop applied coating.

D. Copper Pipe

Pipe shall be bent by method and to radius specified within manufacturer's recommendation and in a manner to ensure surfaces are free of cracks and buckles.

Joints shall be soldered as follows:

1. ream or file pipe to remove burrs;
2. clean and polish contact surfaces of joint;
3. apply flux to both male and female ends;
4. insert end of tube into fittings full depth of socket;
5. bring joint to soldering temperature in as short a time as possible;
6. form continuous solder bead around entire circumference of joint.

All connections between copper and ferrous materials shall be dielectric unions.

3.02 FIELD QUALITY CONTROL

All pipe and fittings shall be pressure tested as specified herein.

The Contractor shall furnish all material, equipment and labor for testing and retesting the piping system.

Each system may be tested as a unit or in sections but each complete system shall successfully meet the requirements specified herein. Should any defects appear in the pipe or fittings, the necessary repair shall be made, and the line retested until it meets the requirements.

Contractor shall take all necessary precautions to prevent any joints from drawing while the pipelines and their appurtenances are being tested. The Contractor shall, repair any damage to the pipes, fittings and their appurtenances or to any other structures resulting from or caused by these tests at no cost to the Trust.

3.03 ADJUSTMENT AND CLEANING

The Contractor shall ensure that all pipe is thoroughly cleaned prior to final assembly.

PART 4 - MEASUREMENT AND PAYMENT

4.01 PIPING AND EQUIPMENT

Payment for piping and equipment will be made at the lump sum price stipulated in the Schedule of Prices for Item R-1 which price and payment shall be full compensation for supply and installation of piping and equipment including pipe; fittings; fixtures; well pump and accessories; meter; back flow preventer; pressure tank, hot water tank; testing; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 15100 - VALVES

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of valves as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of the following items:

1. automatic control valves; and
2. manual ball valves.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

- |                      |               |
|----------------------|---------------|
| 1. Process Equipment | Section 11300 |
| 2. Piping            | Section 15070 |

##### C. Technical Requirements Specified In Other Sections

The following items of work shall be carried out in accordance with the technical requirements of the Sections noted below:

- |                     |               |
|---------------------|---------------|
| 1. Pipe Connections | Section 15070 |
|---------------------|---------------|

#### 1.02 QUALITY ASSURANCE

All valves of the same type shall be by a single manufacturer.

Where specified, valves and operators shall conform to all applicable ANSI standards.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Shop Drawings

The Contractor shall submit shop drawings for all equipment to be supplied by Section 15100 and include shall the information in the maintenance manual.

#### 1.04 PRODUCT DELIVERY AND HANDLING

##### A. Delivery

Valves will be inspected by the Engineer upon delivery to the Site.

Valves shall be delivered complete and in perfect condition to the Site.

Valve ends shall be sealed to prevent entry of foreign matter into valve body.

Valves, actuators and accessories shall be boxed, crated and completely enclosed and protected from accumulation of foreign matter. The Contractor shall provide the Engineer a minimum of 48 hours notice prior to delivery and installation of the valves.

##### B. Storage and Handling

Valves, operators and accessories shall be stored in an area protected from weather, moisture, or possible damage. Material shall not be stored directly on the ground. Valves shall be handled with care to prevent interior or exterior damage.

#### 1.05 IOB CONDITIONS

Valves must be protected against any damage to the interior finish of the valves. Damage to the interior finish of valves must be restored to new condition and approved by the Engineer prior to installation.

### PART 2 - PRODUCTS

#### 2.01 CONTROL VALVES

Control valves shall be Worcester, Series 44 ball valves or equal with carbon steel body and pipe ends, carbon steel stem, neoprene seal, neoprene body seat with screwed ends for valves 2 inches and under and socket weld ends for over 2 inches.

#### 2.02 PVC BALL VALVES

PVC ball valves shall be Hayward Safe Block True Union or Chemtrol True Union ball valves with full port opening, teflon seats, and EPDM "O" rings for socket fittings to Schedule 80 pipe.

#### 2.03 METAL BALL VALVES

Metal ball valves shall be Conbraco Industries, Inc. 70-100 Series, bronze Apollo ball valves or equal with chromium plated ball, reinforced TFE seals and stuffing box ring, adjustable stop lever, and latch lock handle.

## 2.04 GLOBE HAND REGULATING VALVES

Hand regulating globe valves shall be Crane series number 212P threaded bronze globe valves or equal with bronze body and stainless steel trim, compact union bonnet (3" bolted bonnet), plug type disc, rated for 400 psi non shock water service.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

#### A. General

All valves and accessories shall be installed by the Contractor in a manner and location as shown on the drawings or as required for the application and in accordance with manufacturer's instructions. Size of valve shall be equal to line piping in which valve is installed unless otherwise noted on the Drawings. All valves shall be supported where necessary. In case of conflict between these Specifications and a governing code, the higher standard shall prevail.

#### B. Valve Operator

Valves shall be installed with the operator in a position for convenient operation. Particular care shall be taken to ensure that space is available for operation of lever or handwheel operated valves without interference from walls, piping or equipment. Operators for manual valves shall be lever or handwheel as is standard with the manufacturer unless another type of operator is specified or required by the manufacturer. Permanent ladder and platforms shall be provided for access to valves, where required.

#### C. Valve Identification

The Contractor shall provide valves with numbered brass discs attached to valve by brass chain. Provide valve chart indicating valve tag number, location of valve, service, and normal position of valve.

The Contractor shall fully identify all valves by the manufacturer including size, manufacturer's name, and pressure rating.

### 3.02 FIELD QUALITY CONTROL

The Contractor shall perform testing with the piping system that the valve forms part of.

### 3.03 ADJUSTMENT AND CLEANING

The Contractor shall check and adjust valves and accessories for smooth operation. The Contractor shall lubricate valves in accordance with manufacturer's recommendations.

PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for work under Section 15100.

Payment for values will be made under Item R-1 in the Schedule or Prices.

END OF SECTION

## SECTION 15500 - HEATING AND VENTILATING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of heating and ventilating as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of the following:

1. office heating and air conditioning heat pump system with controls;
2. treatment building wall ventilators to exhaust air in unison with outside air intake and to provide two air changes to five air changes per hour;
3. electrical room ventilation for summer cooling ventilation and heated air supply for winter heating;
4. maintenance room ventilation for summer cooling ventilation;
5. heating specialties including balancing dampers, air vents and thermostats;
6. air distribution system including air intakes, discharges, registers and grills, fans and air handling units;
7. a complete control and instrumentation system (electronic) including all controls and control wiring;
8. all steel supports, vibration isolators and hangers for all equipment and piping;
9. insulation for piping, ductwork and equipment as specified; and
10. complete balancing of all air systems.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

- |               |               |
|---------------|---------------|
| 1. Electrical | Section 16001 |
|---------------|---------------|

#### 1.02 QUALITY ASSURANCE

##### A. General

All ductwork construction and installation shall be in accordance with recommendations of the current ASHRAE Guide. The Contractor shall construct in accordance with the



standards of the Sheet Metal and Air Conditioning Contractor's National Association Inc. publication (SMACNA), "Low Velocity Duct Construction Standards".

The external exhaust fan shall bear the AMCA certified ratings for air performance.

All fan shall bear the AMCA Certified Ratings Seal for sound and air performance.

Belt guards shall conform to codes or regulations of agencies having jurisdiction.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Shop Drawings

As a minimum, Shop Drawings shall be submitted for the following:

1. grills, registers and diffusers;
2. fans, louvers, damper motors and automatic or manual controls;
3. unit heaters and controls; and
4. piping and ductwork.

#### 1.04 JOB CONDITIONS

The Contractor shall obtain any necessary direction from the Engineer and coordinate with other Sections before installing equipment, duct, pipes, conduits or fittings which may interfere with the Work of other Sections.

### PART 2 - PRODUCTS

#### 2.01 DUCTWORK

##### A. General

Sheetmetal which is not insulated, shall be cross-broken on all sides of each panel section. Cross-breaking shall be applied to the sheetmetal between the standing seams or reinforcing angles.

When required to divide ducts due to pipes or other obstructions passing through, the Contractor shall provide teardrop shaped deflectors around obstructions. Ductwork around the deflectors shall be increased in size to maintain equivalent free area.

Holes in ductwork shall be caulked and cover-plated to close any space around the obstructions.

In each branch connection, the Contractor shall install a splitter and a butterfly damper in the supply and an intake louvre and damper in the return. Splitter dampers shall extend the full length of the branch duct opening to allow 100% shut-off, and shall be 2 gauges heavier than the ductwork with teardrop at end, rod and set screw locking device. Butterfly dampers over 9 inches in height shall be multiblade with linkage and locking quadrant.

In square elbows, double thickness duct-turns shall be provided for the full height of the ducts at maximum of 2-inch centers, securely riveted to the duct.

Where insulation is applied internally to ductwork, the metal duct shall act as a vapor barrier, and all joints shall be completely sealed. Duct size shall be increased to allow for insulation thickness.

**B. Access Panels**

Duct access doors shall be minimum 18 inches x 12 inches except where duct size is smaller, and shall be constructed from double thickness 20 gauge galvanized sheets, 1 inch apart with necessary reinforcing inside and filled with glass fiber insulation. Openings in ductwork shall be with continuous galvanized reinforcing bars air-tight continuous rubber gasket. Each panel shall have a minimum of two (2) brass window fasteners.

Access doors shall be provided where shown on the Drawings and in other locations required for access.

**C. Flexible Connections**

Connect fan units to ductwork with 6 inch wide 'Ventglas' fabric securely fastened to equipment and ductwork by a galvanized iron band. Ensure that all connections are air-tight.

**D. Acoustical and Thermal Duct Lining**

The Contractor shall provide 1 inch" thick fiberglass duct liner, 1.5 lb. density, and coated with factory applied neoprene compound shall comply with UL rating for non-combustible material.

Apply with welding pins and speed clips on maximum 12 inch centers in staggered arrangement. Use fire-retardant adhesive, as per manufacturer's instructions.

Duct sizes shown are clear inside dimensions, and sheetmetal duct shall be increased in size to accommodate the lining.

**E. Grilles, Registers and Diffusers**

Duct or dampers which might be visible through grilles shall be painted flat black with a paint suitable for the duct material.

Sponge rubber or other approved gaskets shall be provided around all register frames to insure an air tight seal against finished walls or ceiling. Gaskets shall be a color which is compatible with ceiling or wall finish.

Diffusers shall be as specified on the Drawings complete with adjustable dampers and flange rings as required. Finish shall be off-white as supplied from the factory.

Balancing dampers shall be provided for all diffusers, grilles and registers. Approved equipment manufacturer is Hart and Cooley (Tuttle and Bailey).

## 2.02 WALL FANS

Sidewall fans shall be direct driven axial type. Propeller construction shall be of die formed aluminum blades revited to a steel hub. Hubs shall be securely attached to the motor shafts with set screws. Motors shall be permanently lubricated, heavy duty type carefully matched to the fan load and furnished at the voltage, phase and enclosure specified on the Drawings.

The fan panel shall be steel construction with prepunched mounting holes, formed flanges and a deep spun venturi. Panel shall be coated with Perma-Tector to provide a lasting finish. Motor supports shall be heavy gauge welded wire, zinc plated. Four neoprene vibration isolators shall be installed between the motor support and the motor mounts.

Fans shall be model SDE for exhaust as manufactured by Greenbeck Fan Corporation of Schofield, Wisconsin or equal.

The fans shall be provided completed with Greenheck WD-300 motorized backdraft dampers, wall mount collar and weatherhood.

## 2.03 ROOF FANS

Roof exhaust fans shall be centrifugal belt driven type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully mounted to the inlet cone for precise running tolerances. Wheels shall be strategically and dynamically balanced.

The fan housing shall be constructed of heavy gauge aluminum with an internal support structure. The fan shroud shall have a rolled bend for added strength. Motors shall be heavy duty ball bearing type, carefully matched to the fan load and supplied at the voltage, phase and enclosure specified on the Drawings. Motors and drives shall be mounted on vibration isolators, out of the air stream. Fresh air for cooling the motor shall be drawn into the motor compartment from an area free from discharge materials. Motors shall be readily accessible for maintenance. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (T50) life in excess of 200,000 hours at maximum cataloged operation speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing.

A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment. A fan conduit case shall be provided through the curb cap to the motor compartment for ease of installation.

Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for identification. Fans shall be Model GB as

manufactured by Greenbeck Fan Corporation of Schofield, Wisconsin. The fans shall be provided complete with Greenbeck roof curb and WD-100 motorized backdraft damper.

#### 2.04 OFFICE HEATING AND COOLING UNIT

Unit shall be an outdoor roof top mounted, electrically controlled air-to-air heat pump utilizing a reciprocating type compressor for heating and cooling duty. Unit shall discharge air vertically as shown on the Drawings. Unit shall be a Carrier Model 500J004-006 or equivalent Lennox, York with a cooling capacity of 3.5 kW (minimum) and a sensible capacity of 2.0 kW (minimum) at conditions of 875 cubic feet per hour evaporator air entering unit at 73°F wet bulb, 86°F dry bulb and condenser air entering temperature of 95°F dry bulb.

Heating capacity of the unit shall be 2.5 kW. Unit shall include roof curb and economizer with capacity of introducing 100 percent outdoor air. The cooling system shall be protected with high pressurestat, low pressurestat, loss of charge protection and current and temperature sensitive overload devices. Thermostat assembly shall provide staged heating and cooling, automatic changeover and fan control and shall have a set back feature for heating and cooling.

#### 2.05 DAMPERS AND DAMPER MOTORS

4 inch or 6 inch deep Aluminum louvers shall be complete with continuous drainable blade and 1/2 inch, 14 ga. bird screen.

Louvers shall have weatherproof rubber gaskets providing positive seal along blades and frames except where specified otherwise.

Finish shall be standard aluminum finish except dampers in chlorine rooms to have Eisenheiss coating with color to be approved by the Engineer.

Alternate suppliers are: Arrow United Industries, Metal Aire, American Warming or approved equal.

Damper motors shall be adequately sized for operation of dampers under all conditions, operators by Honeywell or approved equal.

#### 2.06 THERMOSTATS AND TIMERS

The Contractor shall provide the following:

1. single or dual set point (activated on temperature rise) thermostats by Honeywell or approved equal for single and dual speed fans respectively; and
2. cycle timers for each single and two speed fan capable of running the fan a set percentage of the time of each hour. Dual speed fans shall be activated on time only on low speed.

#### 2.07 ELECTRICAL CHARACTERISTICS

It shall be the responsibility of the Contractor to insure that the voltage and current characteristics of the electrical equipment are suitable for the electrical services as specified or indicated.

## 2.08 LUBRICATING DEVICES

The Contractor shall provide oil level gages, grease cups, grease gun fittings for machinery bearings as recommended by machinery manufacturer, where lubricating means are not easily accessible extend to accessible locations. Furnish all grease gun fittings of uniform type.

## 2.09 BELT GUARDS

The Contractor shall provide guards to enclose belts, pulleys, sheaves, or belt driven equipment. Construct of galvanized expanded or perforated sheet steel, or 1-inch mesh wire screen in angle frame with steel angle or channel mounting supports, make guard easily removable for access to belt, pulley or sheave. Paint prime and finish coats. Access holes shall be provided for tachometers.

## 2.10 VIBRATION ISOLATIONS

Heating and ventilation equipment shall be mounted using elastomeric isolators of oil resistant neoprene.

# PART 3 - EXECUTION

## 3.01 PERFORMANCE

### A. Controls

The Contractor shall provide the following controls:

1. for each unit heater: built in thermostats, contactors, relays and thermal cutouts, junction boxes and transformers as required;
2. for each single speed fan: a single set point thermostat which will activate the fan and automatic dampers; and
3. summer fan bypass switch for all electrical unit heaters with built in fans.

### B. Rooftop Ventilation Fan

The rooftop ventilation fans shall be activated either manually or by set point thermostats through the contacts. Dampers shall be automatically activated when the rooftop fan is on.

### C. Equipment

The Contractor shall install all equipment in a workmanlike manner. Arrange units and accessories to easily connect and disconnect leaving maintenance parts readily accessible for inspection, operation or maintenance.

The Contractor shall install all equipment in strict accordance to manufacturers instructions leveled and adjusted as required for proper operation.

The Contractor shall provide all necessary supports, brackets, fastenings and guards for all equipment. Supports and fastenings are to be amply sized to give adequate support for the operating loads.

3.02 FIELD QUALITY CONTROL

The Contractor shall be obligated to the following quality control:

1. test and demonstrate controls, switches and thermostats;
2. test and seal ductwork against leakage and noise; and
3. balance air distribution system and give a report of actual air flows at fan speed and measured current from all exhaust and ventilation fans.

PART 4 - MEASUREMENT AND PAYMENT

4.01 HEATING AND VENTILATING

Payment for heating and ventilating will be made at the lump sum price stipulated in the Schedule of Prices for Item S-1 which price and payment shall be full compensation for supply of all fans, ducts and controls for the ventilation systems; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 16001 - ELECTRICAL

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of general electrical provisions as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of the following:

1. 480 volt, 3 phase, AC, 60 Hz feeder from poleline along Route 224 to treatment building;
2. electrical components in new treatment building;
3. communication wire from the poleline on Route 224 to the treatment building;
4. Programmable Logic Control (PLC) with I/O modules and panel in the treatment building;
5. security system;
6. motor control center;
7. electrical components and low voltage power in the treatment building; and
8. all electrical approvals, inspection fees and permits.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

1. Instrumentation and Controls Section 16900

#### 1.02 QUALITY ASSURANCE

##### A. General

All work shall meet all requirements of the latest edition of the National Electrical Code (NEC 90) and all national, state and local regulations that may apply.

The Contractor shall conform to the best practices applicable of this type of work. All equipment and systems shall be installed in accordance with the manufacturer's recommendations, but consistent with the General Requirements of this Specification.

B. Supplier-Installer Qualifications

The Contractor shall be licensed to perform high voltage line work or he shall obtain the services of a licensed subcontractor capable of doing so.

Only first class workmanship will be accepted, not only in regards to durability, efficiency and safety, but also in regards to neatness of detail. The Contractor shall present a neat and clean appearance on completion to the satisfaction of the Engineer. Any unsatisfactory workmanship will be replaced at no cost to the Trust.

1.03 SUBMITTALS

A. General

The Contractor shall comply with Section 01300.

B. Certificate of Acceptance

The Contractor shall furnish a Certificate of Acceptance from approving authority inspection department to the Engineer on completion of work.

C. Test Results

The Contractor shall submit test results to the Engineer upon successful completion of the work.

1.04 PRODUCT DELIVERY AND HANDLING

A. Delivery

Delivery of equipment to the Site shall be arranged as specified in Section 01015.

B. Storage and Handling

The Contractor shall store all electrical equipment and materials in dry locations in a manner satisfactory to the Engineer. The Contractor shall be responsible for the proper storage of equipment and shall ensure that the equipment is protected against damage to the satisfaction of the Engineer.

1.05 JOB CONDITIONS

A. Protection

The Contractor shall comply with all applicable federal, state and local environmental protection requirements, including those applying to transformer oils containing PCBs.

The Contractor shall be responsible for any damage resulting from operations to existing facilities such as underground cables, hard surface areas, watermains, and other utilities. The Contractor shall restore, replace or repair any such damage to the satisfaction of the Engineer. Wherever possible, the Contractor shall obtain locates prior to commencing work.



B. Sequencing and Scheduling

The priority and sequence of the Work will be established by the Engineer. All work will be coordinated through the Engineer.

The Contractor shall cooperate with all other trades on the job, so that all equipment can be satisfactorily installed, and so that no delay is caused to any other Sections.

The electrical work shall be scheduled so that disruption to the rest of the circuitry will be kept to a minimum.

The Contractor shall obtain prior authorization when a circuit will be de-energized.

The Contractor shall ensure service continuity to existing circuits is not affected by the construction work, and shall make temporary connections, if necessary.

PART 2 - PRODUCTS

2.01 GENERAL

The Contractor shall use new materials and equipment unless otherwise specified.

The Contractor shall provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.

The Contractor shall use products of one manufacturer for equipment or material of same type or classification unless otherwise specified.

Materials and equipment of manufacturer specified have been incorporated on the Drawings with space and areas required for the respective manufacturers equipment.

Equipment manufacturer, specified first, is the manufacturer whose equipment is preferred. Second preference is listed second and so on.

Alternate manufacturer's shall be submitted with the bid form provided that the alternate product is adequately described and any adjustment in price is also noted.

For work of this Section, whenever an alternate is proposed, the Contractor shall guarantee that such proposed alternate will not result in any additional expense to be incurred by the Trust due to the use of the alternate product.

Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent is not acceptable.

2.02 MATERIALS

A. Wire

1. All conductors shall be copper.

2. All service and feeders to panels shall be 600 V, THHN insulated conductors.
3. All branch circuit wiring from panels shall be 600 V THHW thermo-plastic insulation.
4. All wiring conductors shall be stranded.
5. Wire smaller than #12 gauge shall not be used except for control systems. Minimum AC control wire shall be #14 gauge. DC and instrument cable circuits shall be as specified on the Drawings or as by manufacturer of the instrumentation.
6. Wire and cable shall be color coded as follows:
  1. Power - Black
  2. Lighting - White - Neutral grounding conductor - Red, Black, Blue - ungrounded conductor
  3. Equipment Grounding - Green
  4. AC Control Wiring - Red
  5. DC Wiring - Blue
  6. Interlock Control Circuit - Yellow
  7. Instrument signal wire, 2 wire twisted pair shielded (+white,-black)
7. Flexible conduit up to six feet in length shall only be used from conduit outlet boxes to light fixture, switches, or receptacles and provided that it is concealed. Liquid tight flexible conduit up to six feet in length shall be used where connecting to motors, solenoid valves control limit switches, etc.

**B. Lighting Fixtures**

See the Drawings for description of fixtures, lamps, ballast voltages and other requirements.

**C. Outlet and Junction Boxes**

1. All outlet and junction boxes in the process area shall be PVC material type for use with rigid PVC conduit systems.
2. All outlet and junction boxes not within the process area shall be galvanized sheet metal and for use with EMT conduit.
3. 4" Octagon boxes shall be used for light outlets.

**D. Receptacles**

15 ampere and 20 ampere as required, 125 volt, A.C. rated, single or duplex as indicated; with wrap-around steel strap attached to receptacle back; automatic grounding feature; water tight twist lock feature for semi permanent pumps and mixers.

**E. Ground Fault Receptacle GFCI**

The Contractor shall install feed through type with test and reset.

F. Cover Plates

1. Receptacles in the process area shall use Hubbell weatherproof covers for duplex receptacles on FS/FD boxes, gray polycarbonate #5221, or approved equal.
2. Light switches in the process area shall use Hubbell weatherproof cover, gray polycarbonate, #7243 or approved equal.

G. Wire Connections

1. Wire connections at motors shall be with Burndy, or approved equal, pressure type lugs using a ratchet type crimping tool and "Everdur" hardware.
2. Control wire and cable terminations, taps, and splices shall be secured with solderless pressure type connectors using a ratchet-type crimping tool. Connectors shall be Thomas & Betts, Burndy, or approved equal at all screw-type connection points.

H. Fuses

Fuses shall be Bussman "Fusetron" time-delay type or approved equal, non-renewable and sized as shown on the Drawings.

I. Panelboards

Lighting panel LP1 shall be 200A, 120/208 volt, 3 phase, 4 wire, 42 circuit panelboard located in the MCC.

J. Disconnect Switches

1. Fusible and non-fusible disconnect switches shall be heavy duty visible blades, external handle for manual operation, and provision for locking in the "OFF" position. The sizes and number of poles are indicated on the Drawings. Auxiliary contacts to monitor position of switch shall be suitable for PCL input.
2. Disconnected switches shall be nonfused safety switches, horsepower rated and complete with auxiliary contracts.
3. Acceptable manufacturers Square D, GE, Westinghouse.

K. Switches

Switches shall be 15 amp, single pole, toggle type as Hubbell #1201-I or approved equal.

L. Identification Plates

Lamacoid material, black letters on white shall be provided as scheduled. Plates shall be screw attached. "Nameplates" shall be used where indicated.

M. Manufacturer's Nameplates

Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent is not acceptable.

N. Underground Warning Tape

Six-inch wide polyethylene warning take tapes permanently colored yellow shall be used for electric underground wiring.

O. Utility Metering Equipment

Meter cabinet, PTs, CTs, and meter shall be obtained from Ohio Edison for mounting on the outside of the electrical room. Underground conduits from the Ohio Edison service shall terminate as follows:

1. two in the enclosure; and
2. two capped 6 inches above ground.

Meter socket shall be transformer rated, 8-jaw Milbank #57235-W with a NEMA 3 rating.

Meter shall be located in or adjacent to the MCC where PTs and CTs shall be mounted.

P. Communication Wire

The communication wire shall be by Beldon or as specified by the manufacturer of the instrumentation and suitable for direct burial.

Q. Electrical Control Components

Electrical control components shall be manufactured by Allen Bradley or approved equal and as indicated on the Drawings.

R. Motor Control Center (MCC)

(1) Mounting

The Motor Control Center (MCC) shall be floor mounted free standing NEMA 1 enclosure painted ASA 61 Gray with side wiring channels front access. The wiring shall be Class 1B with side mounted terminal blocks. The horizontal buss is to be copper 600 amp with 300 amp vertical buss. The buss bracing shall be 42,000 amps symmetrical.

(2) Incoming Section

The incoming section shall be complete with main 400 amp breaker and configured for side entry. The incoming section shall contain voltmeter and ammeter, CTs and PTs and selector switch for plant metering.

(3) Magnetic Starters

The magnetic starters shall be NEMA rated and complete with overload heaters sized to suit the full load current of the motor. The starters shall be circuit breaker style with separate control circuit transformer, external reset on heaters, 2 NO auxiliary contacts on started, 2 NO contacts on overloads, HOA selector switch with extra contacts for remote status, Push to test transformer style green pilot light to indicate running and red pilot light to indicate overload condition.

(4) Control Devices

The control devices shall be oiltight, single hole mounting, mounted in starter cover unless otherwise stated.

(5) Low Voltage Starters

The MCC shall contain the magnetic starters for the well pumps. The well pumps shall be mounted on a blind pan and fed from the extraction well transformer. The pumps shall be 1/3 HP, 240 VAC. Each starter shall have a HOA selector switch, green run pilot light, red overload pilot light, and auxiliary contacts as before. The control devices shall be mounted on the cover of the blind pan door. The starters shall have common control circuit power derived from a common breaker. All wiring shall be brought out to terminal blocks control, separate from power.

(6) Reduced Voltage Starters

Reduced voltage starters shall be autotransformer type, closed transition, with all required control devices.

(7) Push Button Stations:

Green button shall be labelled "Start" red button labelled "Stop", and other designations and labeling as indicated.

(8) Acceptable Manufacturers:

Square D or Allen Bradley.

(9) Security Equipment

The security system shall be a National Guard DS-7090 control center with NGD-7939 door and window contacts and NGD-2404 contacts on roll up doors.

S. Programmable Logic Control (PLC)

PLC shall be TI 405 Series Model 435

T. Computer

Process monitoring computer shall include the following components:

1. one 386 DX-2S Processor;
2. one 387 DX math co-processor;
3. one 120 meg hard drive;
4. one main memory 8 meg;
5. one SVGA graphics with TRIDENT 8900 c/w 1 meg video memory;
6. one Enhanced keyboard;
7. one mouse and drives;
8. one parallel, 2 serial ports controller card;
9. one SVGA monitor flat screen 17 inch;
10. one 3 1/2 inch floppy 1-44 meg;
11. one 5 1/4 inch floppy 1-2 meg; and

12. one Dot matrix printer 24 pin parallel port.

U. Electric Heaters

(1) Unit Heaters

Electric unit heater shall be wall mounted, fan forced type 480 V, 3 phase, with built-in contactor and thermostat. Square D # UP4833 or Chromalox BUH-3 or BUH-5 and as specified on the Drawings.

Double pole thermostats shall be Chromalox.

(2) Baseboard Heaters

Electric baseboard heaters shall be 208 V, single phase, with built-in thermostat as specified on the Drawings.

Thermostats shall be line voltage type, rated 22 amps 277 volts per pole.

Single pole thermostats shall be Square D #85.

Install heaters per manufacturer's recommendations. Maintain all recommended clearances.

V. Electrical Heat Tape

Heat tape shall be Chromalox self-regulating, rapid trace, rated for 8W/FT, 120V, 16 AWG, per Catalog No. RTSR-8L16-1.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall visit the Site of the work and thoroughly ascertain that the work can be carried out satisfactorily without any changes to the Drawings or Specifications. No extras will be allowed for anything which would have been revealed in the course of such an examination.

The Contractor shall refer to the Drawings for dimensions, location of equipment, etc. Field measurements, however, take precedence over dimensioned Drawings. Report any discrepancies discovered between electrical drawings and the drawings of the other sections to the Engineer.

The Contractor shall read Specifications and Drawings of other Sections and conform with their requirements before proceeding with any work specified in this Section related to other trades.

The Contractor shall arrange for openings in the walls and floors for transportation and installation of large and heavy equipment. Cutting and making good of walls will be at no additional cost to the Trust.

If in doubt contact the Engineer for written clarification.

### 3.02 INSPECTION

The Contractor shall notify the inspection department of the approval authority at appropriate stages of the Work.

Engineer will carry out inspections and prepare deficiency list for action by Contractor, during and on completion of the Works.

### 3.03 INSTALLATION

#### A. Lighting and Outlets

The Contractor shall supply and install all light fixtures, receptacles, switches and accessories as specified and shown on the Drawings.

#### B. Installation of Fixtures

Fixtures shall be supported independently of conduit and outlet boxes.

Fixtures shall be installed accurately as to line and level.

Locations of fixtures are generally indicated. Final locations will be as per job conditions.

#### C. Conduit Installation

Conduit shall be installed as follows:

1. conceal conduits as much as possible. Where exposed install parallel within building lines and neatly grouped;
2. size shall suit the number and type of conductors the conduits are carrying and of sufficient size to permit easy removal of conductors at any time. Where sizes are shown on Drawings, these sizes are minimum and in no case shall they be reduced;
3. raceways shall be plugged and kept clean and dry during installation, shall be free from kinks or foreign matter, and all cut or threaded ends reamed;
4. every conduit shall have at least one support. Use only approved conduit hangers. Perforated pipe stays, tie wires, etc. will not be permitted; and
5. install conduits to all devices shown on the Drawings.

#### D. Outlet and Junction Boxes

Outlet and junction boxes shall be supported independently of conduit.

Boxes shall be filled with paper, sponges, or foam or similar approved material to prevent entry of construction materials.

E. Wire Installation

Wires shall be installed as follows:

1. all branch wiring shall be sized and so installed that the voltage drop shall not exceed 3 percent from the panels to the farthest outlet at full load. Circuits sharing a common neutral shall not be connected to the same main phase;
2. wiring shall be installed in conduit systems to outlet boxes;
3. as far as practicable, all feeder cables shall be continuous from origin to panel termination, without running splices in intermediate pull boxes or splicing chambers except as noted in this specification. Sufficient slack shall be left at the termination to make proper connection;
4. no splices shall be pulled into a conduit or be so placed as to be inaccessible; and
5. all wiring for systems, controls, etc. shall be identified on each end by a circuit or wire number using Brady wire wrap markers;

F. Location of Electrical Equipment

The location of any panel, equipment, outlet, raceway and wiring may be changed by the Engineer if the new location is within a limit of 10 foot radius of the original location. The Contractor shall provide changes without extra cost if required before installation in the original locations.

The Contractor shall not install wall mounted equipment at locations where other equipment is to be installed.

G. Mounting Heights

The Contractor shall mount equipment at heights as follows, unless otherwise shown on the Drawings:

1. dimensions refer to the centre line of equipment above the finished floor unless otherwise shown or specified;
2. refer to Architectural elevations when provided or referred to on electrical drawings;
3. if mounting height is not indicated, verify before proceeding with installation; and
4. equipment specification:
  1. panelboards 6 feet to top
  2. individual safety switches 5 feet to top
  3. individual motor controls 5 feet to top
  4. light switches 4 feet to top
  5. convenience receptacles 1 feet to top
  6. thermostat 4 feet to top



H. Labels and Signs

Manufacturers nameplates and labels shall be visible and legible after equipment is installed.

The Contractor shall provide warning signs, as specified or to meet requirements of local authority inspection department and Engineer.

I. Sleeves, Inserts

The Contractor is responsible for supplying and setting of all sleeves and inserts for conduit.

Floor sleeves shall extend 4 inches above floor. All sleeves to be made from Schedule 40 steel pipe.

J. Excavation and Backfilling

The Contractor shall provide excavation, backfilling, and compaction required in connection with his work as specified in Section 02200, and as follows:

1. trenches shall be dug true to line as possible and slope away from the building entrances;
2. the Contractor shall provide protective material around and over services existing or newly installed and shall be present at all times during excavation and backfilling to supervise work;
3. non-concrete encased electrical conduits installed in trenches shall be supported on a minimum of three inches of sand and covered with an additional three inches of sand before backfilling unless otherwise indicated;
4. trenches shall be backfilled using the native backfill material provided stones or other debris are not larger than two inches in any dimension;
5. all trenches containing high voltage ducts or conduits shall have buried utility marker tape 6 inches wide buried 12 inches below finished grade installed continuously for the length of the trench; and
6. where trenches are left open until the installation has been inspected, proper covers, barricades and warning signs shall be provided.

K. Concrete Bases, Curbs, and Steel Supports

All concrete bases required for electrical equipment shall be provided as specified in Section 03300.

The Contractor shall furnish and install all structural steel supports, platforms, braces, tie rods, etc., required to support or hang all equipment. All supports shall be attached to the building structure Supporting electrical equipment, wiring, conduit, etc., from ductwork, piping, equipment, etc., will not be accepted.

L. Cutting and Patching

All cutting of openings to walls, floors, foundations, footings, ceilings, plaster and drywall ceilings, roof manhole casings or any other surfaces or finishes shall be the responsibility of the Contractor.

All patching, painting and making good of walls, floors, ceiling, partitions, roof and manhole casings shall be completed by the Contractor and shall be done by a qualified tradesman specializing in that particular field and to the satisfaction of the Engineer.

M. Wiring Terminations

Lugs, terminals, screws used for termination of wiring shall be suitable for copper conductors.

The Contractor shall identify wiring with permanent indelible identifying markings, either numbered or colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

The Contractor shall maintain phase sequence and color coding throughout.

N. Grounding

The Contractor shall provide all equipment grounding as required to meet requirements of inspection authority regardless of whether it has been shown on the Drawings or called for in this specification.

The Contractor shall arrange grounds so that under normal operating conditions no injurious amount of current will flow in any grounding conductor.

If ground is insufficient for proper protection, additional rods shall be added to meet requirements at no additional cost to the Trust.

O. Control of Debris

At all times the premises shall be kept free from all accumulations of debris resulting from the electrical work.

P. Treatment Building

The Contractor shall supply and install the treatment system components as shown on the Drawings.

Q. PLC Supervisory Control System

The Contractor shall supply PLC software for programming of the PCL from Texas instruments and process software for control of the treatment system (WEB Version 2-2 available from Arthur Baier Co.).

R. Motor Control Center

MCC and associated equipment shall be installed as shown on the Drawings.

S. Electrical Heat Tape

The Contractor shall install electric heat tape to all exterior exposed riser piping and suitably encircle each pipe per manufacturer's recommendation and to the satisfaction of the Engineer.

T. Lightning Arrestor

The Contractor shall supply and install lightning arrestor on power feed coming in and on all communications and telephone connections. Grounding shall be sufficient for pumping protection of equipment.

U. Finish Paint

Unless otherwise noted, all equipment shall be factory finished with a prime coat and two coats of good quality finish paint.

The Contractor shall protect work so that finishes shall not be damaged or marred during construction. The necessary protection shall be maintained until completion of the Works.

Damages to finish on factory finished equipment shall be touched up to the Engineer's satisfaction. Items suffering major damage to finish shall be replaced at the direction of the Engineer, and at no cost to the Trust.

3.04 FIELD QUALITY CONTROL

The Contractor shall conduct acceptance tests to demonstrate that the equipment and systems actually meet the specified requirements. Tests may be conducted as soon as conditions permit, and consequently the Contractor shall make all changes, adjustments, or replacements required as the preliminary tests may indicate prior to the final tests.

Tests shall be carried out in the presence of the Engineer.

The Contractor shall provide instruments, meters, equipment and personnel required to conduct the following tests during and at conclusion of the project:

1. Insulation and Resistance Testing

1. Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
2. Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

2. Voltage and Current Testing

Measure and tabulate voltage and currents (480V and 120V) nominal levels at the treatment building, measure circuits on each service main feeder and each motor and adjust taps on transformer feeds to plant to ensure 480 V.

## PART 4 - MEASUREMENT AND PAYMENT

### 4.01 GENERAL ELECTRICAL PROVISIONS

Payment for general electrical provisions will be made at the lump sum price stipulated in the Schedule of Prices for Item T-1, which price and payment shall be full compensation for all labor, materials and equipment required to complete the supply and installation of the secondary electrical service to the treatment building, MCC, building services and process equipment; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 16900 - INSTRUMENTATION AND CONTROLS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply, installation and commissioning of instrumentation and controls as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, supply and installation of the following items:

1. instruments;
2. PLC;
3. software;
4. telemetry;
5. field instruments; and
6. other controls in the treatment plant facility.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

- |                            |               |
|----------------------------|---------------|
| 1. Painting                | Section 09900 |
| 2. Process Equipment       | Section 11300 |
| 3. Heating and Ventilating | Section 15500 |
| 4. Electrical              | Section 16001 |
| 5. Instrument List         | Attachment E  |

#### 1.02 QUALITY ASSURANCE

##### A. General

##### (1) Description

The groundwater collection system consists of the following components:

1. a pipe and media drain (design flow 36 gallons per minute) located along the southerly side of the Site for the collection of groundwater in the Water

Table Unit (WTU) and with eight cleanout manholes (MH1 to MH8) located equally spaced along the pipe drain;

2. one wet well with duplex submersible pumps to pump collected groundwater to the on-Site groundwater treatment system;
3. Six bedrock extraction wells (design flow 1 gpm each, total 6 gpm), five located along the pipe and media drain adjacent to MH-3 through MH-7 and one located adjacent to the wet well; and
4. NaOH storage tank and chemical metering pump.

The groundwater treatment system has components which include:

1. an equalization/aeration tank with a 100 cubic feet per minute air blower and a 55 gpm recirculation transfer pump;
2. a gravity overflow plate clarifier with chemical storage/metering pump, mixer and bottom drain to an air double diaphragm sludge pump;
3. a surge tank and recirculation/transfer pump to transfer water from the lamella plate settler to the bio tower;
4. two nutrient and one inoculum storage tanks and pumps;
5. upflow biotower with one aeration blower, one bumping blower and one recirculation pump and gravity overflow to a sand filter;
6. an upflow sand filter with a continuous back wash with overflow to a surge tank and sludge tank respectively;
7. a surge tank with two 50 gpm recirculation/transfer pumps;
8. two 20,000 pound activated carbon adsorbers;
9. a treated water storage tank with gravity overflow to a treated water discharge pump; and
10. a 4200 gallon sludge storage tank and bag dewatering system for treatment of the sludge.

Flow through the system will be automatic based on the following:

1. water level in the manholes;
2. water level in the bedrock wells;
3. manually adjusted flow rate from each bedrock extraction well (normally 1 gpm each)
4. water level in wet well;
5. manually adjusted flow rate from each duplex pump in the wet well (normally 50 gpm each);

6. flow rate through the forcemain to the treatment system (normally 50 gpm with one pump, 100 gpm with two pumps);
7. a maximum flow rate through the equalization/aeration, plate settler and biotower of up to 50 gpm; and
8. a bypass flow rate when over 50 gpm to the sand filter and carbon adsorber.

(2) Controls

1. MH-1, MH-2 and MH-8

High water level switch will alarm during high water level conditions and stop bedrock pumps

2. MH-3 to MH-7 and Wet Well

Controls shall include the following:

1. high water level switch will alarm during high water level conditions and stop associated bedrock wells;
2. low water level will allow bedrock pump to run;
3. increasing water level in wet well will start first wet well pump at high level switch;
4. low water level in wet well will stop first wet well pump;
5. increasing water level in wet well above first high level switch will start second wet well pump;
6. low water level in wet well will stop first and second pump together;
7. wet well pump will start alternate;
8. flow rate of wet well pumps will be manually set at the wet well via electric flow control sensor/transmitter/ball valve assembly with digital flow indicator at wet well; and
9. flow totalization will be recorded at the treatment facility.

3. Extraction Wells

Controls shall include the following:

1. flow rate of the extraction pumps will be manually set at the pump chambers via electric flow control sensor/transmitter/electric actuator/ball valve assembly; and
2. pump down level controls will stop/start extraction pumps.

4. Flow Through Treatment Systems

Controls shall include the following:

1. flow into the treatment systems will be monitored by flow sensor/indicator on influent forcemain;
2. flow rate up to 50 gpm will be directed to aeration/equalization tank with system by pass valve closed; and
3. flow rate above 50 gpm will be regulated to the aeration/equalization tank by flow control sensor/transmitter/electric actuator/ball valve assembly and to the by pass line by a transmitter/electric actuator/ball valve assembly.

5. NaOH Addition (T1, P1)

pH of groundwater inflow to treatment system is monitored and used to regulate the NaOH metering pump to adjust pH up to 8-10.

6. Equalization/Aeration Tank (T2) and pump (P2)

Controls shall include the following:

1. level in the tank controls the flow out of the tank by regulating the control valve (LV 109) in the recycle line;
2. at low level pump P2 is off and the control valve (LV 109) is fully open;
3. as the water level in T2 rises, P2 is turned on with flow being recycled to be into T2;
4. as level continues to rise LV 109 closes directing flow forward to the inclined plate settler (X1); and
5. if the level still rises a high level alarm is given and if the level rises even further the wet well pumps are shut off and will not run until level is restored to set point where P2 starts.

7. Inclined Plate Settler (X1)

Controls shall include the following:

1. pH of water from X1 is monitored and at a low set point of 6.0 pH the acid metering pump P4 will run to readjust pH to 7.0; and
2. a second pH sensor located upstream of the biotower serves to check pH and the acid metering pump P4 will run to further adjust pH to 7.0.



8. Surge Tank #1 (T4) and Pump (P3)

Controls shall include the following:

1. level in the tank controls the flow out of T4 by regulating the control valve (LV120) in the recycle line; and
2. at low level, pump P3 is off and LV120 is firmly open as the level rises P3 is turned on with flow being recycled back into T4, as level continues to rise LV120 closes directing flow forward to the bioreactor (X2), if the level still rises a high level alarm is given, and if the level rises even further pump P2 is shut off and will not turn on again until level is down to the set point where P3 turns on initially.

9. Bioreactor (X2)

High level in the bioreactor provides alarm.

10. Surge Tank #2 (T8) and pumps (P9 and P10)

Controls shall include the following:

1. level in the tank controls the flow out of T8 by regulating the control valve (LV 142) in the recycle line;
2. at low level, pumps 9 and 10 are both off and LV 142 is fully open as the level rises; and
3. P9 is turned on with flow being recycled back into T8, as level continues to rise LV 142 closes directing flow forward to the carbon adsorption units (X4 and X5), if the level still rises pump P10 turns on, if the level rises further an alarm is given, and if the level rises even further pump P3 is shut off and will not turn on again until the level is down to the set point where P9 turns on. Pump P10 shuts down once the level has dropped, while P9 continues to run.

1.03 SUBMITTALS

A. General

The Contractor shall comply with Section 01300.

B. Drawings

The Contractor shall provide the following instrumentation drawings as a minimum:

1. dimensioned, referenced front of panel layouts and general arrangement drawings;
2. internal panel layout drawings;
3. fully itemized and referenced panel wiring and termination drawings;

4. fully itemized instrument loop drawings for all analog process loops, to be generally in accordance with ISA. S54 Format;
5. completed instrument record sheets in accordance with ISA format; and
6. communications system interface connection diagrams.

C. Software

The Contractor shall supply software documentation package including software that will provide listings, cross referenced and logic flow diagrams.

Descriptions of operation shall include logic description, function of all switches, indicators, displays, alarm status and trouble shooting guide.

Software shall be supplied to the Engineer for programming.

D. Documentation

The Contractor shall provide the following documentation:

1. six copies of the hardware manufacturers instruction manuals and parts lists for PLC and all associated equipment;
2. six copies of all instrument manuals for the equipment supplied and recommended spare parts; and
3. wiring diagrams showing wiring numbers, junction boxes and pull boxes.

## PART 2 - PRODUCTS

### 2.01 GENERAL

A. Instrument Requirements

Unless otherwise specified, the Contractor shall provide instruments in accordance with the following general requirements:

1. provide NEMA 4 enclosure for all instruments installed in non-hazardous, indoor locations;
2. power supply is 120 V AC or 24 V DC, as shown on the Drawings;
3. provide 4 - 20 ma, linear, isolated output capable of driving a minimum of 1000 ohms;
4. provide all necessary brackets or stands to mount instrument;
5. supply any spare parts or calibration instruments required to commission instruments; and
6. instrument tags will be generally to ISA.S5.1. Where signals must be assigned by instrument system supplier as required.

B. Program Controller

The programmable controller shall be a Texas Instruments Series 405 with the following minimum specifications:

- |                                   |              |
|-----------------------------------|--------------|
| 1. 435 CPU Processes              | - 435 CP4;   |
| 2. 8 K memory Cartridge           | - G-14M;     |
| 3. 2-Base units 8 slots           | - U-08B;     |
| 4. 6-16 point input AC            | - U-25N;     |
| 5. 3-8 point relay output         | - U-01T;     |
| 6. 3-8 channel analog input       | - 405-8ADC;  |
| 7. 2-4 channel analog output      | - 405-4DAC;  |
| 8. 1-PID module                   | - 40S-PID;   |
| 9. 1-Power supply                 | - 40S-ID EX; |
| 10. 1-expansion cable             | - U-10J; and |
| 11. 1-TISOFT Programming software |              |

The controller and equipment to be mounted in the PLC cabinet and all 110 wired to terminal blocks. The TISOFT programming software shall be supplied to the Engineer within two weeks of receiving the Contract.

The control panel shall have all necessary fusing for protection of circuits. AC and DC wiring shall be run in separate wiring duct.

The control panel shall be constructed of cold rolled steel finished wire white paint on inside of door and box, ASA 61 gray outside the construction shall meet NEMA 12 Standards. All front of panel wiring shall be routed and supported to prevent twisting of wires.

All pilot devices shall be Allen Bradley 800T heavy duty type. The pilot lights shall be transformer type markers. All wire markers shall be slip on plastic sleeve.

PART 3 - EXECUTION

3.01 PREPARATION

A. Material Control

All field instruments shall be identified with a permanent, weatherproof label showing tag number and service. The Contractor shall use engraved Lamacoid, or stamped stainless steel and fix with non-rusting screws or wire.

The Contractor shall complete instrument record sheet at time of calibration and ensure instrument meets specification. Record sheets shall be available to the Engineer during construction/installation period. The Contractor shall provide certificate of correctness of installation and operation.

Record sheets shall be turned over to the Engineer on final acceptance.

**B. Supports and Frames**

The Contractor shall provide support or frames if not already supplied by manufacturer of equipment.

Written permission shall be obtained from the Engineer before fixing supports or frames to structural members.

**3.02 INSPECTION**

The Contractor shall arrange and pay for special inspection approval for the electrical authority for any equipment which does not already carry full approval.

The Contractor shall install instrumentation and controls as follows:

1. mount instruments in strict accordance with manufacturer's recommendations;
2. ensure instruments and their associated sensors are easily accessible for maintenance, calibration, withdrawal/replacement;
3. install instruments, in accordance with drawings and manufacturer's recommendations;
4. provide power cabling and conduit from MCC and signal wiring in conduit to PLC;
5. install PLC panel in the MCC room panel as shown on the Drawings;
6. terminate the telephone circuits as required by the utility. Install other telephone outlets as indicated on the Drawings. Install and connect approved lightning surge protection on telephone lines;
7. install pressure switches, limit switches, flow switches, solenoid valves, vacuum gauges/switches, instrument alarm contacts and level controls with wiring and conduit as required to interface to PLC;
8. install automatic telephone dialer, 4 channel Chatterbox or equal by Raco. Connect alarm outputs and connect to telephone line. Provide for programming the dialer for critical alarms; and
9. beldon 6 conductor cable with DB25 connectors at each end shall be supplied to connect PLC to computer.

**3.03 TRAINING**

The Contractor shall provide five (5) days training to the Trust's operating staff on the operation and maintenance of the system, at a time scheduled by the Engineer.

PART 4 - MEASUREMENT AND PAYMENT

4.01 INSTRUMENTATION AND CONTROLS

Payment for instrumentation and controls will be made at the lump sum price stipulated in the Schedule of Prices for Item U-1 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to supply, install and commission the instrumentation and controls for the groundwater treatment facility; training of Trusts' operating staff; and all other miscellaneous items for which separate payment is not provided in other Items.

END OF SECTION

D

**APPENDIX D**

**QUALITY ASSURANCE PROJECT PLAN  
GROUNDWATER TREATMENT SYSTEM**

**REMEDIAL CONSTRUCTION QUALITY  
ASSURANCE PROJECT PLAN  
GROUNDWATER TREATMENT SYSTEM**

**Summit National Superfund Site  
Deerfield Township of Portage County, Ohio**

**MAY 1993**

**REF. NO. 2372 (34)**

This report is printed on recycled paper.

**CONESTOGA-ROVERS & ASSOCIATES**



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## **1.0 INTRODUCTION**

### **1.1 BACKGROUND INFORMATION**

The Summit National Superfund Site (Site) is located in Deerfield Township of Portage County, Ohio, at the intersection of Ohio Route 225 and U.S. Route 224, approximately 45 miles southeast of Cleveland, Ohio. The location of the Site is illustrated on Figure 1.1 of the Remedial Construction (RC) Work Plan.

The Site was originally used as a coal strip mine and contained a coal wash pond and coal stockpile, prior to its use by Donald Georgehoff, Summit National Services and/or Summit National Liquid Disposal Services for the operation of a hazardous waste treatment, recycling, storage and disposal facility.

Prior to implementation of remedial work activities, operations at the Site resulted in uncontrolled releases of hazardous materials. Subsequent Site investigations indicated that there was significant contamination in Site soils, and that groundwater contamination existed both on and off Site.

### **1.2 PURPOSE AND ORGANIZATION OF REPORT**

This Remedial Construction Quality Assurance Project Plan (RC QAPP) presents the quality assurance program to be implemented

during construction of the groundwater treatment system at the Site as detailed in the RC Work Plan, to ensure that the groundwater treatment system is constructed to meet or exceed all design criteria, plans and specifications. This report is organized as follows:

- i) Section 1.0 presents the background information, purpose and organization of the report;
- ii) Section 2.0 provides a description of the project;
- iii) Section 3.0 outlines the project organization and responsibilities;
- iv) Section 4.0 presents the personnel qualifications requirements;
- v) Section 5.0 presents the project meeting requirements;
- vi) Section 6.0 describes the inspection and testing activities required to ensure that construction and materials comply with all design specifications and plans; and
- vii) Section 7.0 describes documentation requirements of construction quality assurance (CQA) activities.

Construction specifications for the Groundwater Treatment System are presented in Appendix D of the RC Work Plan, and also on the "C" Construction Drawings.

## **2.0 PROJECT DESCRIPTION**

The first phase of the Remedial Action (RA) to be implemented at the Site, as required by the Consent Decree, is the construction and commissioning of a groundwater treatment system at the Site, and associated activities. As detailed on Figure 15.1 of the RC Work Plan, the groundwater treatment system must be completed within 12 months of United States Environmental Protection Agency (USEPA) and Ohio Environmental Protection Agency (OEPA) formal approval of the Final Design Report. Installation of the groundwater treatment system phase of the RA consists of the activities detailed in Section 6.1 of the RC Work Plan.

### **3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES**

It is anticipated that the remedial construction activities will be initiated by Conestoga-Rovers & Associates (CRA) on behalf of the Summit National Facility Trust (SNFT). The project organization chart is presented on Figure 3.1. A brief description of the duties of the key personnel are presented below.

#### **3.1 PROJECT MANAGER**

The duties of the Project Manager are as follows:

- i) provides overall project management;
- ii) ensures professional services by CRA are cost effective and of highest quality;
- iii) ensures all resources of CRA are available on an as-required basis;
- iv) participates in key technical negotiations with United States Environmental Protection Agency (USEPA) and Ohio Environmental Protection Agency (OEPA); and
- v) provides managerial and technical guidance to CRA's Project Coordinator.

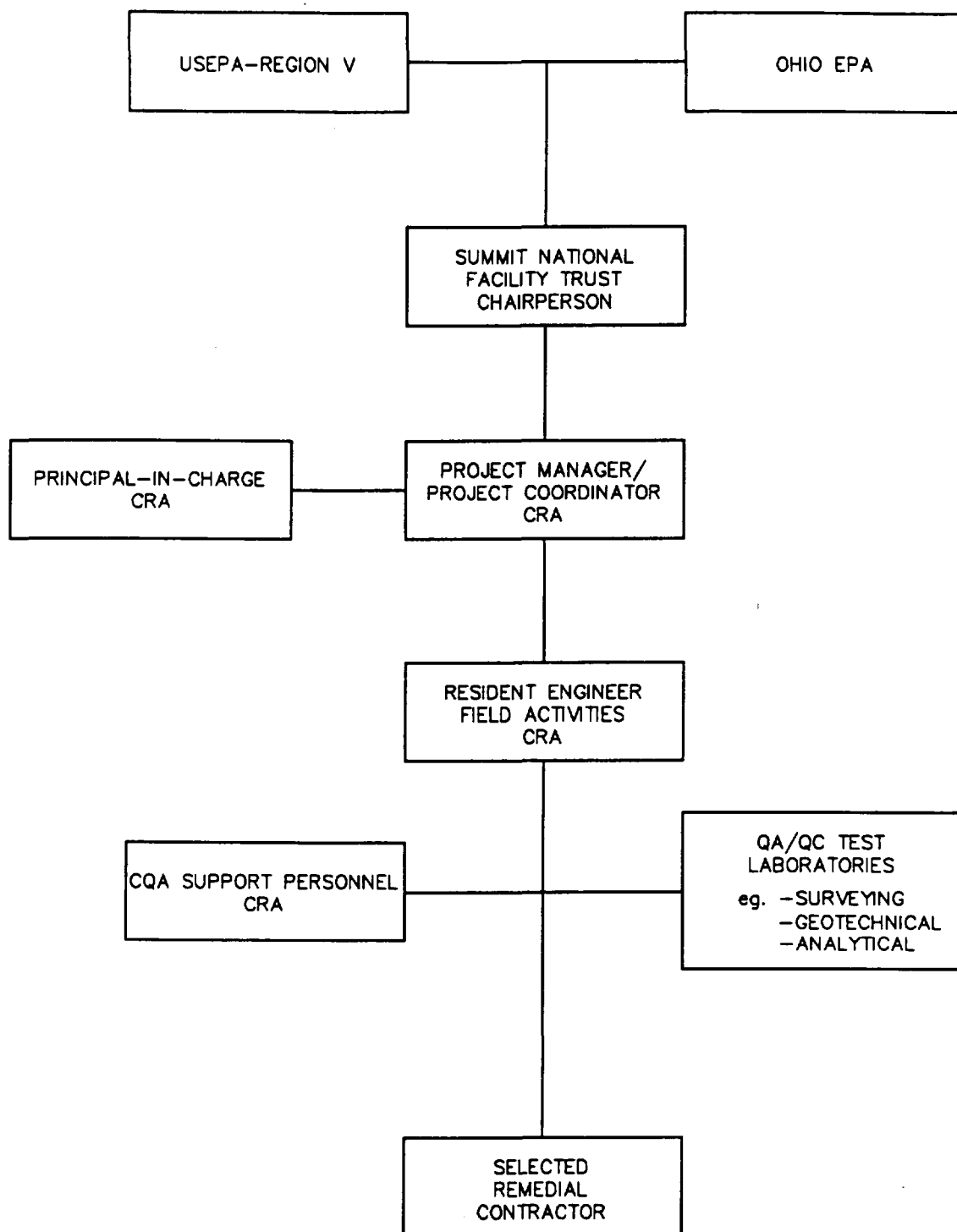


figure 3.1

PROJECT ORGANIZATION  
REMEDIAL CONSTRUCTION ACTIVITIES  
SUMMIT NATIONAL SUPERFUND SITE  
*Deerfield Township of Portage County, Ohio*

**CRA**

### 3.2 PROJECT COORDINATOR

The duties of the Project Coordinator are as follows:

- i) provides day-to-day project management;
- ii) provides managerial guidance to CRA's technical group;
- iii) provides technical representation at meetings as appropriate;
- iv) retains testing firms to perform quality control field/laboratory tests;  
and
- v) prepares and reviews reports.

### 3.3 RESIDENT ENGINEER

The duties of the Resident Engineer are as follows:

- i) reports to CRA Project Coordinator;
- ii) provides immediate supervision of all on-site project activities;
- iii) provides field management of CQA activities;
- iv) reviews design criteria, plans and specifications for clarity and completeness so that the RC QAPP can be implemented;
- v) informs CQA support personnel on CQA requirements and procedures;
- vi) ensures that regular calibration of testing equipment is conducted and recorded;
- vii) ensures that all site activities are recorded daily and maintained;
- viii) ensures that CQA test results are accurately recorded;



- ix) identifies work that should be accepted, rejected, or uncovered for observation, or that may require special testing, inspection, or approval;
- x) rejects defective work and verifies that corrective measures are implemented; and
- xi) interacts daily with the contractor to provide assistance in modifying the materials and work to comply with the specified design.

The individual designated to be the Resident Engineer will be specified by CRA prior to commencement of the construction activities.

#### 3.4 COA SUPPORT PERSONNEL

The duties of the CQA Support Personnel are as follows:

- i) reports directly to the Resident Engineer;
- ii) conducts CQA tests and inspections as indicated in this RC QAPP;
- iii) accurately records test results and inspections;
- iv) calibrates testing equipment as required;
- v) maintains testing equipment in good working order; and
- vi) immediately notifies Resident Engineer whether or not test results comply with design specifications.

### 3.5 QA/QC TEST LABORATORIES

QA/QC Test Laboratories that will conduct CQA Quality Control tests will be identified by CRA prior to the commencement of the construction activities. The duties of the QA/QC Test Laboratories are to provide QA/QC testing of construction activities, as requested by the Resident Engineer, to confirm construction activities have been implemented according to the construction specifications and drawings.

### 3.6 CONTRACTOR

The duties of the Contractor, as they relate to QA/QC, are as follows:

- i) retains qualified testing firms (for example laboratory, geotechnical), for testing of materials and workmanship to ensure that materials meet specified requirements;
- ii) submits samples and/or materials for testing to determine if samples/materials meet specified requirements, and submits results directly to the Resident Engineer;
- iii) records daily CQA activities in the Contractors Site log book and submits a "Daily Construction Quality Control Report" (see Section 7.3) to the Resident Engineer; and
- iv) carries out construction activities according to design specifications.

#### **4.0 PERSONNEL QUALIFICATIONS**

##### **4.1 RESIDENT ENGINEER**

The Resident Engineer will have the following qualifications:

- i) graduate of a recognized college in a technically related field;
- ii) minimum two (2) years experience in the oversight and implementation of hazardous waste remedial construction and CQA activities; and
- iii) good management and communication skills.

##### **4.2 COA SUPPORT PERSONNEL**

The CQA support personnel will have the following minimum qualifications:

- i) degree from a recognized college in engineering technology, or equivalent; or a minimum of two (2) years experience in hazardous waste remedial construction and CQA inspection procedures; and
- ii) working knowledge of all relevant codes and regulations concerning material and equipment installation, observation and testing procedures, equipment, documentation procedures, and site safety.

#### 4.3 CONTRACTOR

The selected contractor will assign experienced personnel to supervise the implementation of each of the remedial construction activities specified in the RC Work Plan. In particular, the selected contractor will assign experienced personnel to the following critical remedial construction activities:

- i) demolition, excavation and relocation of contaminated soils and sediments;
- ii) installation of pile foundations and reinforced concrete foundations and slabs;
- iii) installation of structures;
- iv) installation of mechanical and electrical components;
- v) commissioning of mechanical and electrical components.

Experienced personnel will have a thorough knowledge of testing procedures, equipment and documentation procedures required for implementation of the remedial construction activities.

The selected contractor will designate an on-Site Project Manager empowered to act on behalf of the contractor in all matters pertaining to the remedial construction activities.

## 5.0 PROJECT MEETINGS

Project meetings as detailed herein will be held during the remedial construction period to ensure that all tasks are accomplished according to schedule and that they are completed in accordance with the remedial construction plans and specifications. These progress meetings will be attended by the Project Manager, Project Coordinator, Resident Engineer, Contractor Representative, SNFT, USEPA and/or OEPA as detailed below.

### 5.1 PRECONSTRUCTION MEETING

**Purpose:** To resolve any uncertainties in the remedial construction plans and specifications, and to review levels of responsibility, reporting requirements, and health and safety requirements.

**Present:** Project Coordinator, Resident Engineer, CQA Support Personnel, Contractor Representative.

**Topics:**

- Present RC QAPP, Contractors Site-specific Health and Safety Plan, and other relevant documents.
- Review the activities to be conducted during the remedial construction.
- Review roles of each organization relative to the design criteria, plans and specifications within the RC QAPP.

- Determine any need to modify the RC QAPP that may be necessary to ensure that the construction is performed to meet or exceed the specified design criteria.
- Review lines of authority and communication.
- Discuss the established procedures or protocol for observations and tests including sampling strategies.
- Discuss the established procedures or protocols for handling construction deficiencies, repairs and retesting.
- Review methods for documenting and reporting inspection data.
- Review methods for distributing and storing documents and reports.
- Review work area delineation, security and safety protocol.
- Discuss the location for storing construction equipment and materials, and the protection of these items during inclement weather.
- Discuss the protection of uncompleted construction work during off hours and during inclement weather.
- Conduct a Site tour to review construction areas, safety areas, and equipment and stockpile storage locations.

## 5.2 DAILY PROGRESS MEETINGS

**Purpose:** To daily review work schedule progress. This meeting is intended to be an informal meeting held at the end of each work day or at the start of each work day.

**Present:** Resident Engineer, Contractor Representative

**Topics:**

- Review previous day's activities and progress.
- Review work location and activities for upcoming day.
- Review health and safety deficiencies from the previous work day and review health and safety requirements and potential problems for the next day's activities.
- Review Contractor's personnel and equipment assignments for the upcoming day.
- Discuss any potential construction problems.

### **5.3 WEEKLY PROGRESS MEETINGS**

**Purpose:** To provide an update of work schedule progress on a weekly basis, and identify schedule slippages and efforts required to get back onto schedule, if required.

**Present:** Resident Engineer, CQA Support Personnel (optional), Project Coordinator (optional), Project Manager (optional), Contractor Representative, Site Safety Officer (optional).

**Topics:**

- Health and Safety report for previous week's activities and forthcoming week activities.
- Review work activities for the previous week.

- Comparison of actual progress to scheduled work activities, noting of schedule slippages and actions to be implemented to rectify schedule slippages.
- Review work activities for the next week.
- Review potential construction problems and proposed solutions.

#### 5.4 MONTHLY PROGRESS MEETINGS

Purpose: To provide a remedial construction progress update to SNFT, USEPA and OEPA.

Present: Project Manager, Project Coordinator, Resident Engineer, SNFT, Contractor's Representative, USEPA and OEPA.

Topics:

- Health and Safety report for previous month's activities.
- Review of the work activities for the previous month.
- Comparison of actual progress to scheduled work activities, noting of schedule slippages and actions implemented to rectify schedule slippages.
- Summarize work activities scheduled for the next month.
- Review potential remedial construction problems/conflicts for the next month's remedial construction activities and proposed solutions to the potential problems/conflicts.



## 5.5 PROBLEM OR WORK DEFICIENCY MEETINGS

**Purpose:** If a problem or deficiency is present or likely to occur.

**Present:** Resident Engineer and CQA Support Personnel,  
Contractor Representative (optional if major problem  
directly related to his work)

**Topics:**

- Define and discuss problem or deficiency.
- Review alternative solutions.
- Develop and implement a plan to resolve the problem or deficiency.

For all meetings held on Site during the remedial construction, with the exception of the daily progress meetings, minutes will be taken by the Resident Engineer. Copies of the minutes will be forwarded to SNFT and all organizations present at the meetings.

## 6.0 INSPECTION AND TESTING ACTIVITIES

### 6.1 SCOPE

Throughout the implementation of the construction program there will be numerous inspections and testing requirements for specific work tasks. The inspection and testing requirements will ensure compliance with the contract specifications, applicable building codes as well as ensure completion of the work tasks to the highest level of quality.

Inspections and testing will provide a qualitative means of monitoring the quality and progress of work performed.

The components of each work task which will require some form of inspection or testing as described by the CQA Plan include:

- i) Geotechnical/Soils
  - quality of native material
  - compaction of backfill
  
- ii) Concrete Work
  - installation of form work
  - placement of steel reinforcing
  - placement of concrete

- iii) Steel Work
  - installation of structural steel
  - connections/tolerances
  
- iv) Masonry
  - fire wall separation
  
- v) Architectural Work
  - fire protection construction
  
- vi) Demolition and Removal Activities
  - clearing and grubbing
  - demolition of coal tipple structures
  
- vii) Mechanical Components
  - groundwater treatment equipment testing including pumps, blowers, sand filter, carbon adsorbers, flow meters, valves and other appurtenances
  - pressure testing of tanks and piping
  
- viii) Electrical Components
  - level and pressure sensors and transmitters
  - groundwater treatment system control center
  - power supply

## 6.2 INSPECTIONS

Throughout the period of remedial construction the quality of work completed and material used for each of the work tasks will be maintained at its highest possible level through regular inspections of the work. Inspections will be completed throughout the construction by the Resident Engineer, CQA support personnel, and representatives of USEPA and OEPA on a periodic basis, if required.

In general, inspections to be conducted by the Resident Engineer and CQA support personnel include the following:

- i) daily inspections of the work progress;
- ii) inspections of material as it is delivered to the Site to check for damage during delivery;
- iii) comparison of the material delivered to the Site to the design specifications to ensure that the proper material has been delivered to the Site;
- iv) inspection of materials after they have been installed to ensure that it has not been damaged during installation;
- v) A pre-construction inspection will be performed prior to beginning work on any work task. A pre-construction inspection will include the following:
  - a review of contract requirements to ensure that all materials and/or equipment have been tested according to applicable standards and specifications,

- ensure that provisions have been made to provide required quality control testing, and
  - examination of the work area to ascertain that all applicable preliminary work tasks have been completed;
- vi) General inspections will be performed periodically as the amount of work completed warrants an inspection. A general inspection will include the following:
- examination of the quality of workmanship,
  - testing of materials for compliance with Contract requirements,
  - any omissions, and
  - general progress of work performed; and
- vii) A final inspection will be performed upon completion of each work task to ensure compliance with the Construction Drawings and Construction Specifications and to ensure that deficiencies identified in the general inspections have been corrected.

These inspections will be performed by the Resident Engineer and the results of the inspections will be provided in the final construction report. USEPA and OEPA representatives will be notified by the Resident Engineer at least 3 days in advance of any final inspections. The results of all inspections will be recorded in the daily Site log book as described in Section 7.0. Copies of the pre-construction, general and final inspection reports will be provided to SNFT and all parties involved in the inspection.

The components of each work task to be inspected, the types of inspections required and the frequency of the inspections are summarized in Table 6.1.

### 6.3 TESTING

In addition to the daily inspections of the construction progress, material testing will be carried out as required. Material testing will be performed to ensure compliance with material specifications and design criteria as presented in the Construction Specifications.

The testing requirements, methods of testing, testing frequency for each of these work task components and submittals (test reports, certificates, verifying material quality/workmanship, etc.) are summarized in Table 6.2 and have been incorporated into the construction specifications for the groundwater treatment system.

TABLE 6.1

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS  
GROUNDWATER TREATMENT SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Inspected</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Submittals to Resident Engineer</i>
<b>A. Geotechnical/Soils</b>			
• Foundation Excavation	• excavation specifications	• measurement of layout and depth	• upon completion of excavation
• Engineered Fill/Gravel Base	• existing anomalies not accounted for in Geotechnical Report	• visual	• none
	• gravel gradation specifications	• check supplier's gradation	• prior to delivery on site
	• gravel base specified	• visual (grade stakes or level)	• upon completion
	• compaction specifications	• compaction	• during compaction
			• grain size distribution curve
			• none
			• compaction results
<b>B. Piles</b>			
• Steel H piles (33)	• equipment conforms to specification materials	• visual	• prior to start
	• conform to specification	• visual	• once
	• shoes (cutter) attachment to pile	• visual	• each
	• grade inspection	• visual on levels	• prior to start
	• location and direction of straight piles	• measurement	• each
	• batter on battered piles	• measurement	• each
	• energy of hammer (driving)	• visual	• continuous
	• cut off lengths	• visual	• each
	• splicing	• visual	• each
	• cap installation	• visual	• each
			• installation records
			• installation records
			• installation records
			• none
			• none
<b>C. Concrete Work</b>			
• Concrete	• concrete mixes conform to design specifications, ACI, 301, 318	• verify supplier's concrete mix	• prior to delivery on site
	• pipe configuration below floor slab meet design specification	• visual (tape measurement)	• prior to concrete placing
	• concrete placing comply with ACI 306 if air temperature is below 40°F	• visual	• continuous during concrete placing
	• concrete placing comply with ACI 305 if air temperature is above 77°F	• visual	• continuous during concrete placing
	• poured in-place concrete protected from mechanical disturbance and vibration during hardening	• visual	• continuous during concrete placing
			• certification that mix will produce concrete of specified quality and yield
			• none
			• none
			• none

TABLE 6.1

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS  
GROUNDWATER TREATMENT SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

Work Task Component to be Inspected	Type of Inspection		Frequency of Inspection	Submittals to Resident Engineer
C. Concrete Work				
• Concrete	• time from the mixture of concrete batch to placement of concrete	• visual	• per truckload	• none
	• composite samples collected in accordance with ASTM C172	• visual	• per load of concrete	• none
	• specimens from each sample are molded and secured in accordance with ASTM C31	• visual	• during specimen collection	• none
	• concrete thickness and grade meet design specification	• visual	• during concrete placing	• none
• Reinforcement Material	• reinforcement material specifications	• check manufacturer's	• upon delivery to site	• manufacturer's specifications
	• reinforcement placement complying with ACI 301, 318, 350.	• conform to drawings	• prior to pouring concrete	• none
• Formwork/Falsework	• formwork complies with ACI 301	• visual	• prior to pouring concrete during installation	• certificates, test reports or other proof of conformity, shop drawings
	• falsework complies with specifications	• shop drawings		
• Anchor Bolts/Anchors	• anchor bolts/anchors complies with specifications • correct placement of anchor bolts/anchors in concrete	• visual	• after concrete pouring	• none
D. Steel Work				
• Fabrication and Erection	• materials conform to ASTM A36  • fabrication and erection • connections • tolerances	• visual	• daily during installation	• certification that work has been carried out in accordance with specifications and



**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS  
GROUNDWATER TREATMENT SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Inspected</i>	<i>Type of Inspection</i>		<i>Frequency of Inspection</i>	<i>Submittals to Resident Engineer</i>
<b>E. Masonry</b>	<ul style="list-style-type: none"><li>• fire wall separator</li><li>• masonry conform to design specifications ASTM C90,C129, C145, C55</li><li>• time from the mixture of mortar to the placement of mortar</li><li>• horizontal and joint reinforcing</li><li>• anchors</li></ul>	<ul style="list-style-type: none"><li>• visual</li><li>• verify suppliers materials</li><li>• visual</li><li>• visual</li><li>• visual</li></ul>	<ul style="list-style-type: none"><li>• daily during construction</li><li>• prior to delivery on site</li><li>• per batch</li><li>• daily during construction</li><li>• upon completion</li></ul>	<ul style="list-style-type: none"><li>• certification that masonry conforms to OBBC</li><li>• certification that masonry will produce specified quality and yield</li><li>• none</li><li>• none</li><li>• none</li></ul>
<b>F. Architectural Work</b>	<ul style="list-style-type: none"><li>• materials used for fire rating comply with specifications</li><li>• built in accordance with specifications</li></ul>	<ul style="list-style-type: none"><li>• visual</li><li>• visual</li></ul>	<ul style="list-style-type: none"><li>• daily during installation</li><li>• daily during installation</li></ul>	<ul style="list-style-type: none"><li>• none</li><li>• none</li></ul>
<b>G. Demolition and Removal Activities</b>	<ul style="list-style-type: none"><li>• removal of structures</li><li>• clearing and grubbing</li></ul>	<ul style="list-style-type: none"><li>• visual</li><li>• visual</li></ul>	<ul style="list-style-type: none"><li>• daily during construction</li><li>• daily during construction</li></ul>	<ul style="list-style-type: none"><li>• none</li><li>• none</li></ul>
<b>H. Mechanical Components</b>				
<ul style="list-style-type: none"><li>• Installation of groundwater treatment equipment</li></ul>	<ul style="list-style-type: none"><li>• do specifications of mechanical components meet design specifications</li><li>• are mechanical components being assembled according to specifications</li></ul>	<ul style="list-style-type: none"><li>• check supplier's specifications</li><li>• visual</li></ul>	<ul style="list-style-type: none"><li>• upon delivery to site</li><li>• continuously during assembly</li></ul>	<ul style="list-style-type: none"><li>• manufacturer's operating and maintenance literature</li><li>• shop drawings</li><li>• contractors written verification and guarantee</li></ul>
<b>I. Electrical Components</b>				
<ul style="list-style-type: none"><li>• Installation of Panelboards, Wire, Meters, Control Components, etc.</li></ul>	<ul style="list-style-type: none"><li>• do specifications of electrical components meet design specifications</li><li>• are electrical components being assembled according to specifications</li><li>• check equipment calibration</li></ul>	<ul style="list-style-type: none"><li>• check supplier's specifications</li><li>• visual</li><li>• test</li></ul>	<ul style="list-style-type: none"><li>• upon delivery to Site</li><li>• continuously during assembly</li><li>• before installation/start-up</li></ul>	<ul style="list-style-type: none"><li>• Certificate of Acceptance</li><li>• test results upon successful completion of installation</li><li>• none</li></ul>

TABLE 6.2

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE TESTING  
GROUNDWATER TREATMENT SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Tested</i>	<i>Type of Test</i>	<i>Standard</i>	<i>Frequency of Test</i>	<i>Criteria</i>
<b>A. Geotechnical/Soils</b>				
• Engineered Fill/Gravel Base	• maximum dry density	• ASTM D698 and ASTM D2216	• minimum 1 test for each change in material	• NA
	• bulk density	• ASTM D1556 or ASTM D2167 or ASTM D2922 whichever is appropriate	• minimum of 1 test per 500 cu. yd.	• minimum 95% Standard Proctor Density
• Loam Soil	• gradation	• ASTM D422 or ASTM D1140 whichever is appropriate	• minimum of 1 test per 5,000 cu yd of material removed at source • minimum of 1 test for any change in material used in fill	• >25% wt < 0.005 mm @ particle size; >55% wt passing No. 200 sieve
	• See Engineered Fill/Gravel Base			
	• Permeability	• ASTM D2434	• minimum 1 test per 2,000 cu. yd. • minimum 1 test for any material change	• $1 \times 10^{-4}$ cm/s
<b>B. Concrete Work</b>				
	• compressive strength (*) (**)	• ASTM C39	• 1 compressive strength test per concrete truck load • 2 specimens for 7 and 28 days (compressive strength)	• 3500 psi at 28 days unless stated otherwise
	• slump (*) (**)	• ASTM C143	• at beginning, middle, and end of a particular concrete truck load • whenever concrete consistency varies	• to be determined from Concrete Mix specifications
	• total air content (*) (**)	• ASTM C173 or ASTM C231	• one for every strength test	• to be determined from Concrete Mix specifications
	• temperature of concrete sample (*) (**)	• ASTM C1064	• 1 for every slump test one for every strength test or as required	• 40°F < Temperature < 77°F
<b>C. Masonry Walls</b>	• compressive strength	• ASTM C90, C129, C145, C35	• minimum of 1 test per truck load	• to be determined from design specifications
<b>D. Mechanical</b>				
• Tanks, Pipes, Valves, Fittings, Connections, etc.	• leakage	• NA	• after installation and after any repairs	• minimum fluctuation of 5 psi at 100 psi applied pressure, over 2 hours
	• Hydrostatic	• NA	• after installation and after any repairs	• minimum fluctuation of 5 psi at 140 psi applied pressure, over 1 hour
<b>E. Electrical</b>				
	• calibration	• NA	• before installation	• as specified
	• wiring continuity	• NA	• after installation	• as specified
	• PLC programming/control circuits loop checks	• NA	• after installation	• as specified
	• motors bumped to check operation and rotation	• NA	• prior to installation	• as specified

**Notes:**

- \* If more than one (1) batching plant is being used, these frequencies shall apply to each batching plant separately
- \*\* Type of test and its frequency shall be considered minimums and shall be added to or increased as determined necessary by the Contractor
- 1. ASTM - American Society for Testing and Materials
- 2. ACI American Concrete Institute
- NA Not Applicable

## **7.0 COA DOCUMENTATION**

### **7.1 GENERAL**

This section details the documentation requirements for the RC QAPP. The proper, thorough, and accurate documentation of all CQA site activities is important in ensuring quality installation. CQA testing will be documented daily.

### **7.2 CONTRACTORS DAILY SITE LOG BOOK**

The selected remedial contractor will record daily quality control activities in a Daily Site Log Book to be kept on Site at all times. The log book will include the following information:

- i) date, weather conditions;
- ii) all Site activities;
- iii) decisions made regarding approval of units of material or of work, and/or corrective actions to be taken in cases of substandard quality;
- iv) submittals made by suppliers verifying material quality;
- v) quality control test and inspection results;
- vi) construction delays, and causes;
- vii) areas affected by delays;
- viii) construction problems and corrective actions;
- ix) personnel on Site;
- x) present phase of construction;

- xi) material and/or equipment delivered to site (including equipment demobilization);
- xii) inspections made;
- xiii) health and safety considerations;
- xiv) quality control tests performed and results of tests taken on previous work day;
- xv) instructions given by the Resident Engineer;
- xvi) changed conditions/conflicts encountered; and
- xvii) remarks.

Each daily entry into the log will be signed by the remedial contractor as verification to its correctness, and a copy of the signed entry will be provided to the Resident Engineer on a daily basis for verification. An example of this report sheet is presented in Appendix A. The Contractor may use alternate forms providing the same information, subject to the approval of the Resident Engineer.

### 7.3 CQA INSTRUMENT CALIBRATION

The CQA support personnel will record calibrations of test equipment in an Instrument Calibration Log Book, maintained on Site by the Resident Engineer. Actions taken as a result of recalibration will be recorded in the Inspection log book, as described in the next section.

#### 7.4 INSPECTION LOG BOOK

All observations and quality control field tests will be recorded by the CQA support personnel into Inspection Log Books. These books will be kept on Site and maintained by the Resident Engineer. The inspection log book will include the following information:

- i) date, time, weather conditions;
- ii) description or title of the inspection activity;
- iii) location of the inspection activity or location from which the sample increment was obtained;
- iv) type of inspection activity and procedure used (reference to standard method when appropriate);
- v) recorded observation or test data, with all necessary calculations;
- vi) results of the inspection activity and comparison with specification requirements;
- vii) personnel involved in the inspection activity; and
- viii) signature of the appropriate CQA inspection personnel and concurrence by the Resident Engineer.

Items above shall be formulated into checklists so that details are not overlooked.

## 7.5 PROBLEM/CORRECTIVE ACTION REPORTS

A problem is defined as material or workmanship that does not meet the construction specifications. Problem/Corrective Action Reports should be cross-referenced to specific inspection entries in the Inspection Log Book where the problem was identified. Problem/Corrective Action Reports will include the following information:

- i) unique identifying sheet number for cross-referencing and document control;
- ii) detailed description of the problem;
- iii) location of the problem;
- iv) probable cause;
- v) how and when the problem was located (reference to Inspection Log Book);
- vi) estimation of how long problem has existed;
- vii) suggested corrective action;
- viii) documentation of correction (reference to Inspection Log Book);
- ix) final results;
- x) suggested methods to prevent similar problems; and
- xi) signature of the appropriate CQA support personnel and concurrence by the Resident Engineer.

In some cases, not all of the above information will be available or obtainable. However, when available, such efforts to document problems could help to avoid similar problems in the future.

## 7.6 WORK TASK REPORTS

Within each work task, there may be several quality characteristics, or parameters, that are specified to be observed or tested, each by a different observation or test, with the observations and/or tests recorded in different Inspection Log Books. At the completion of each task, these log books should be used to write a Work Task Report summarizing all of the construction activities related to that particular work task.

Work Task Reports will be prepared by the Resident Engineer or the Project Coordinator and will include the following information:

- i) unique identifying sheet number for cross-referencing and document control;
- ii) description of work task (i.e., installation of underground forcemain, construction of pipe and media drain, etc.);
- iii) quality characteristic being evaluated and references to construction specifications and plans;
- iv) quality control test locations;
- v) inspections made (define procedure by name or other identifier);
- vi) summary of inspection results, which will include all data outside acceptable limits, and documentation of corrective action and retest results;
- vii) define acceptance criteria (compare task inspection data with design specification requirements; indicate compliance or noncompliance; in

the event of noncompliance, identify documentation that gives reasons for acceptance outside of the specified design); and  
viii) signature of the Resident Engineer or Project Coordinator.

## 7.7 FINAL REPORT

At the completion of the remedial construction, CRA will submit a final report to USEPA, OEPA and SNFT. This report will include copies of all of the Daily Site Log Books, Inspection Log Books, Problem/Corrective Action reports, deviations from design and material specifications (with justifying documentation), and as-constructed drawings.

The final report will re-emphasize that areas of responsibility and lines of authority were clearly defined, understood, and accepted by all parties involved in the project. Signatures of CRA's Project Coordinator and Resident Engineer should be included as confirmation that each party understood and accepted the areas of responsibility and lines of authority and performed their functions in accordance with the RC QAPP.

## 7.8 STORAGE OF RECORDS

During remedial construction the Resident Engineer will maintain a copy of the Construction Drawings and the Construction Specifications, RC QAPP and Problem/Corrective Action reports in the Site office. Once the remedial construction is complete, all CQA documents



(originals) will be retained by CRA, and a copy sent to SNFT. This information will be kept until all operating and post closure monitoring periods have expired as specified in the Consent Decree.

APPENDIX A

TYPICAL CONTRACTORS DAILY SITE LOG BOOK

## TYPICAL CONTRACTORS DAILY SITE LOG BOOK

Project Name: Construction of Groundwater Treatment System Date: \_\_\_\_\_

Summit National Superfund Site

Weather: \_\_\_\_\_ Report No. \_\_\_\_\_

1) Personnel On Site

a) CRA

b) Contractor

c) Subcontractor

d) Other

2) Phases of Construction in Progress (Give briefly only phase or phases of work in progress)

3) Health and Safety

a) Preparatory

b) Initial

c) Follow-up

4) Material and/or Equipment on-Site (Including equipment demobilization)

5) Inspection Made (Include negative inspections, phase of in-progress construction work inspected and all deficiencies noted during inspections)

6) Tests Performed and Results of Tests (including results of tests taken on previous dates).

- 7) Instructions Received (List any instructions given by Resident Engineer on construction deficiencies, retesting required etc., with action to be taken).
- 8) Changed Conditions/Conflicts Encountered.
- 9) Remarks

SIGNATURE \_\_\_\_\_

TITLE \_\_\_\_\_

Contractor's Verification: The above report is complete and correct and all material and equipment used and work performed during this reporting period are in compliance with the construction plans and specifications except as noted above.

\_\_\_\_\_  
Contractor's Approved Authorized Representative

E

APPENDIX E

CONSTRUCTION SPECIFICATIONS  
GROUNDWATER EXTRACTION SYSTEM

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## SECTION 01010 - SUMMARY OF WORK

### 1. SCOPE OF WORK

The Works to be performed under this Contract consist of construction of Groundwater Extraction System and associated work at the Summit National Superfund Site, Deerfield Township, Ohio.

### 2. LOCATION

The Site is located on the southeastern corner of the intersection of Routes 224 and 225 in Deerfield Township of Portage County, Ohio.

### 3. ACCESS TO SITE

Access to the Site is available from Route 224.

The Contractor shall make all arrangements with the authorities having jurisdiction for the movement of his material and equipment to and from the Site over public roadways.

### 4. DESCRIPTION OF WORK

Work includes, but is not necessarily limited to, the following:

1. mobilization of material, equipment, plant and personnel necessary to satisfactorily perform the Works;
2. development, implementation and maintenance of a Site-specific Health and Safety Plan;
3. development and submission of all pre-construction, during construction and post construction submittals;
4. provision and maintenance of construction facilities and temporary controls;
5. relocation of south drainage ditch and perimeter security fence;
6. reconstruction of east drainage ditch;
7. dewatering of on-Site pond and relocation of pond retaining wall;
8. excavation, transfer and on-Site stockpiling of contaminated surficial soils and sediments;
9. demolition of existing structures;
10. supply and installation of a pipe and media drain, including 6-inch diameter perforated HDPE pipe, filter fabric, clear stone and imported backfill;
11. supply and installation of six extraction well chambers;

12. supply and installation of 2-inch and 3-inch diameter high density polyethylene (HDPE) forcemains;
13. supply and installation of eight access manholes and a one wet well manhole in the pipe and media drain;
14. supply and installation of 2-inch diameter PVC electrical and control conduits and wires from existing treatment plant to extraction wells, wet well and access manholes;
15. supply and installation of mechanical and electrical components and controls to service six extraction well pumps, two wet well pumps and eight access manholes;
16. excavation, transfer, placing and regrading of on-Site soil and debris to pre-grade elevations;
17. installation of monitoring well and piezometer surface casings;
18. supply and installation of clean imported permeable final Site cover, including vegetation;
19. construction of permanent access road and improvement to existing access roads as required; and
20. demobilization and project closeout.

5. CONSTRUCTION SCHEDULE

The Contractor shall perform the Works in accordance with the following construction schedule:

1. the Works shall be commenced at the Site within seven (7) calendar days of the date of the Notice to Proceed; and
2. the Works shall be completed within 210 calendar days from the date of the Notice to Proceed.

6. DRAWINGS

Drawings issued with and forming part of the Contract Documents are listed below. Such Drawings are issued for bid purposes only:

<i>Drawing No.</i>	<i>Rev. No.</i>	<i>Date of Drawing or Latest Revision</i>	<i>Title</i>
D-1	2	February 1993	Existing Conditions
D-2	2	February 1993	Site Preparation and Demolition
D-3	2	February 1993	Site Work

D-4	2	February 1993	Grading Plan
D-5	2	February 1993	Pipe and Media Drain Profile
D-6	2	February 1993	Typical Details I
D-7	2	February 1993	Typical Details II
D-8	2	February 1993	Typical Sections

The Contractor shall perform the Works in accordance with Drawings signed "Approved for Construction" by the Engineer. Such Drawings will be issued to the Contractor after award of the Contract and will consist of bid Drawings revised as required by the Engineer and additional Drawings if required by the Engineer.

Revised "Approved for Construction" Drawings may be issued from time to time by the Engineer and such Drawings shall supersede previous revisions. If revised "Approved for Construction" Drawings are issued which necessitate changes to the Contractor's shop drawings not yet reviewed, no separate payment will be made for the Contractor's expenses involved in revising such shop drawings.

7. MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for work under Section 01010.

END OF SECTION

## **SECTION 01015 - GENERAL REQUIREMENTS**

### **1. PROJECT STARTUP**

Prior to mobilizing to the Site, the Contractor shall provide all bonds and insurance as required by the Contract Documents and to the satisfaction of the Engineer.

Prior to commencing work at the Site, the Contractor shall mobilize all material and equipment required for performance of the Works; erect all temporary fencing; provide all construction facilities and temporary controls including parking areas, all necessary connections to power, water, telephone and sewer and access roads as required.

The Contractor shall site all construction facilities in areas designated by the Engineer. Any changes to the locations of construction facilities shall be approved by the Engineer.

The Contractor shall ensure all utilities and surface features potentially affected by the Works are located in and around all active work areas prior to commencement of the Works.

The Contractor shall ascertain and record the conditions of existing surface features at all work locations under this Contract.

### **2. CONTRACTOR'S REPRESENTATIVE**

During the performance of the Works, the Contractor shall have on the Site during working hours a designated Superintendent empowered to act on behalf of the Contractor in all matters pertaining to the Contract. The Contractor shall within seven days of execution of the Contract, nominate such person or persons, in writing, to the Engineer. Such person or persons shall remain, in the context of this Contract, the Contractor's designated agent(s) until such time as notification to the contrary is received in writing by the Engineer.

### **3. MEASUREMENT METHODS**

Further to Article 7 of the Agreement, measurement clauses in these Project Specifications define methods the Engineer will use to determine quantity of completed work for payment purposes.

The Contractor shall notify the Engineer sufficiently in advance of operations to permit required measurements for payment and shall provide reasonable and necessary opportunities and facilities for making such measurements.

The Contractor shall provide at his own expense a qualified assistant(s) to the Engineer to expedite the taking of these measurements and to facilitate agreement on pay item quantities.

### **4. DELIVERY OF EQUIPMENT AND MATERIAL**

No material or equipment of any kind shall be delivered to the Site until approval in writing has been applied for and obtained by the Contractor from the Engineer that such material or equipment may be delivered.

The Contractor shall ensure that the delivery of material and equipment to the Site is coordinated with the work sequence and stored in areas approved by the Engineer. Delivered equipment and material shall be protected from contamination prior to and during use in the Works.

5. OTHER CONTRACTORS

Other Contractors may be working on the Site. The Contractor shall cooperate with and coordinate his activities with Other Contractors. No additional payment will be made for delays, changes in schedule, or any other work due to the fact that Other Contractors are working on the Site.

6. QUALITY CONTROL

A. INSPECTION

The Engineer shall have access to the Works. If parts of the Works are in preparation at locations other than at the Site, the Contractor shall provide access to such work whenever it is in progress.

The Contractor shall give timely notice requesting inspection if work is designated for special tests, inspections or approvals or by instructions of the Engineer or other authorities having jurisdiction.

If the Contractor covers or permits to be covered any part of the Works that has been designated for special tests, inspections or approvals before such is made, the Contractor shall uncover such work, have the inspections or tests satisfactorily completed and make good such work at no additional cost to the Trust.

The Engineer may order any part of the Works to be examined if such work is suspected to be not in accordance with the Contract Documents. If, upon examination such work is found not in accordance with the Contract Documents, the Contractor shall correct such work and pay the cost of examination and correction. Except as specified above, if such work is found to be in accordance with the Contract Documents, the Trust will pay the cost of examination.

B. INDEPENDENT TESTING AGENCIES

Independent testing agencies may be engaged by the Trust for the purpose of inspecting and/or testing portions of the Works.

The Contractor shall allow inspection/testing agencies access to the Works whenever it is in preparation or progress and shall provide reasonable facilities for such access.

Employment of testing agencies by the Trust does not preclude or relax the responsibility of the Contractor to perform as specified.

If defects or deficiencies are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain the full degree of the defect or deficiency. The Contractor shall correct defects and deficiencies as directed by the Engineer at no additional cost to the Trust.

The Contractor shall pay costs for retesting and reinspection.

C. PROCEDURES

The Contractor shall notify the appropriate agency and the Engineer in advance of the requirement for tests, inspections or approvals, in order that attendance arrangements can be made.

The Contractor shall submit samples and/or materials required for testing, as specifically requested in the Project Specifications. The Contractor shall submit with reasonable promptness and in an orderly sequence so as not to cause delay in the performance of the Works.

The Contractor shall provide labor and facilities to obtain and handle samples and materials at the Site.

D. REJECTED WORK

The Contractor shall remove defective work, whether the result of poor workmanship, use of defective products or damage and whether incorporated in the Works or not, which has been rejected by the Engineer as failing to conform to the specified requirements.

The Contractor shall make good Other Contractor's work damaged by such removals or replacements promptly.

If in the opinion of the Engineer it is not expedient to correct defective work or work not performed in accordance with the Contract Documents, the Trust may deduct from the Contract Price the difference in value between the work performed and that called for in the Contract Documents, the amount of which shall be determined by the Engineer.

7. EXISTING CONDITIONS

Prior to commencement of work at the Site, the Contractor shall inspect the Site with the Engineer to review and establish the condition of all surface features including existing buildings, trees and other plants, grassed areas, fencing, service poles, wires, paving and survey bench marks or monuments on or adjacent to the Site which may be affected by the Works. This inventory shall be mutually agreed between the Engineer and the Contractor and shall not thereafter be subject to dispute. Such inventory as may be amended, from time to time, will be used by the Engineer to check compliance by the Contractor with the requirements of the Contract Documents.

The Contractor shall provide ongoing review inspection and attendance during performance of the Works to properly document conditions. The Contractor shall inform the Engineer within seven (7) calendar days of any existing conditions at the Site affected by the Works which may require restoration, repair or replacement. The Contractor shall not cover up any of the Works without prior approval from the Engineer.

The Contractor shall protect existing buildings and other surface features from damage which may be affected by the Works while work is in progress and repair any resulting damage from the Works to the Engineer's approval.



8. RESTORATION

A. GENERAL

This Clause describes minimum requirements and not necessarily all the requirements for restoration work.

The Contractor shall supply all labor, materials and equipment and do all work necessary or required to restore the Site as specified and shown on the Drawings.

Restoration shall mean replacement, repairs or reconstruction to a condition at least as good as or better than the condition prior to commencement of the Works.

Except where specifically required by other Sections of the Project Specifications, the Contractor shall restore areas of the Works and areas affected by the performance of the Works to conditions that existed prior to commencement of the Works and to match condition of adjacent, undisturbed areas.

The Contractor shall be responsible to restore the Site, including all areas affected by the performance of the Works, and shall utilize construction methods and procedures during the performance of the Works which keeps disturbance and damage of whatever nature to existing conditions to the practical minimum. Where the works necessitate root or branch cutting, the Contractor shall do so only as approved by the Engineer.

Unless specified otherwise, the Contractor shall ensure that quality, grades, elevations and extent of bedding, backfill and other materials including subgrades, finish grades, thickness of pavements for roadways and parking areas are properly documented during their removal to ensure reconstruction to at least their original and functional condition.

B. MATERIAL

Material required for restoration work shall be provided by the Contractor subject to the approval of the Engineer prior to use.

Restoration material shall be new, except as otherwise specified, not damaged or defective and of the best quality for the purpose intended. If requested by the Engineer or specified in other Sections of the Project Specifications, the Contractor shall furnish evidence as to type, source and quality of materials or products provided.

Should any dispute arise as to the quality or fitness of materials, whether obtained on the Site or off the Site, whether previously inspected by the Engineer prior to use or not, the decision to use any material or product in the finished Works will rest strictly with the Engineer.

Material not approved for reuse shall become the property of the Contractor and shall be removed from the Site.

The Contractor shall handle and store products or materials in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

### C. PERFORMANCE

The Contractor shall notify the Engineer sufficiently in advance of any required attendance to assess and/or document existing conditions.

Prior to commencement of restoration work, the Contractor shall inform the Engineer of proposed material, methods and procedures to repair, replace or reconstruct any disturbed, damaged or suspected damaged to the Works.

The Contractor shall perform cutting, remedial and coordination work required to make the parts of the Works fit together.

The Contractor shall ensure that restored areas match existing grade and surface drainage characteristics, except as otherwise specified, and ensure a smooth transition from restored surfaces to existing surfaces.

The Contractor shall not alter original conditions without approval from the Engineer.

The Contractor shall dismantle and/or salvage materials for reuse where practicable except as otherwise specified. The Contractor shall exercise due care when removing material for salvage. Materials damaged through improper handling or through loss after removal shall be repaired or replaced by the Contractor at no additional cost to the Trust.

The Contractor shall store and protect removed material approved for reuse in approved locations.

Unless otherwise specified, restoration of pavement shall be made by removing and replacing the entire portions between joints or scores and not merely refinishing or patching localized areas.

In removing pavements, curbs and gutters and similar structures or surfaces, the Contractor shall saw cut surfaces and protect adjacent joints and load transfer devices and underlying granular materials.

### 9. LAYOUT

The Engineer will establish reference bench marks and baselines adjacent to the Works.

The Contractor shall be responsible for the preservation of all survey reference points as set or established by the Engineer. Any errors entering into the Works through failure of the Contractor to notify the Engineer concerning lack of preservation of such survey reference points shall be made good by the Contractor at no additional cost to the Trust.

The Contractor shall develop and make such additional detailed surveys as are needed for construction, such as slope stakes, line and grade stakes for forcemains, batterboards, stakes for establishing the design elevations of the working points, lines and elevations. All bench marks, base lines, property boundaries, line and grade hubs, and other references and construction points, and such survey points shall thereafter be maintained by the Contractor.

The Engineer may, at any time, check the Contractor's survey and layout work but this shall not relieve the Contractor of any of his responsibilities to carry out the Works to the lines and grades as set out in accordance with the Drawings and Project Specifications.

The Contractor shall provide reasonable and necessary opportunities and facilities for setting points and making measurements during construction. The Contractor shall not proceed until he has made request to and has received from the Engineer, such points as may be necessary as the work progresses. The construction shall be done in conformance with such points.

10. WORK AREAS

The Trust will provide the right of access to certain lands in connection with the Works. The Contractor shall not unreasonably encumber these premises with its plant, equipment or materials. No other areas on the Site shall be used by the Contractor without the Engineer's written approval.

11. LANDS BY CONTRACTOR

The Contractor shall provide, with no liability to the Trust, any additional land and access thereto not shown or described that may be required for temporary construction facilities or storage of materials. The Contractor shall construct and maintain all access roads, detour roads, or other temporary work as required by its operations. All such areas shall be approved by the Engineer prior to construction.

12. INTERFERENCE WITH EXISTING PLANT

The Contractor shall conduct operations to minimize interference with the existing plant, and shall comply with any regulations in force. Where it is necessary to interrupt existing services for purposes of demolition work, connecting work, re-routing systems or changing over to new arrangements, all related and preliminary work shall be scheduled and completed in advance, except for necessary final connecting or removal, as the case may be, to ensure minimum shut down time.

13. COORDINATION WITH ADJACENT OPERATIONS

The Contractor is advised that operations of facilities adjacent to the Site must be maintained (to the maximum extent possible) throughout the execution of the Works. The Contractor shall arrange and perform all work in such a manner as to cause minimum interference to adjacent operations or personnel.

14. DISRUPTION OF SERVICES

Where it is necessary to interrupt existing services, the Contractor shall advise the Engineer a minimum of 72 hours in advance of a proposed shut down or interruption of services, utilities or access to any adjacent facility and shall not proceed with such shutdown or interruption until authorization to proceed has been issued by the Engineer. Where it is necessary to interrupt existing services, all related and preliminary work shall be scheduled and completed in advance, except for necessary final connecting or removal, as the case may be, to ensure minimum shut down time. No additional payment will be made for delays resulting from failure to authorize the interruption within 72 hours or modifications required to the proposed sequence of work to accommodate adjacent operations.

The Contractor shall identify all potentially required shut down or interruptions of service utilities or access to any adjacent facility and expected duration on the Contractor's detailed construction schedule.

The Contractor shall coordinate the Work to ensure alternate access routes, points of entry, or service connections are not interrupted at the facilities located adjacent to the Site.

15. HAZARDOUS WASTE

No waste that is considered to be hazardous, or is subject to regulation under any applicable law, statute, rule, regulation, or ordinance, shall be treated or disposed on the Site except as approved by the Engineer. No such waste shall be stored in violation of any such applicable requirements. Liability and responsibility for any and all hazardous waste produced during the performance of this Contract shall be the sole liability and responsibility of the Contractor.

16. CLEAN UP

No material of any kind shall be removed from the Site without prior approval from the Engineer.

The Contractor shall not allow any part of the Site to become littered with trash and/or waste material, and shall maintain the same in a neat and orderly condition throughout the performance of the Works.

Daily accumulations of solid waste material which have been in contact with contaminated materials, such as discarded safety equipment, debris and rubbish, shall be collected and properly containerized for disposal.

Non-contaminated solid waste materials from the Site offices, lunch room and security office shall be segregated from contaminated solid wastes removed from the work areas.

Non-contaminated solid waste materials shall be removed from the Site in a timely manner or as directed by the Engineer such that accumulation of waste materials at the Site is minimized. Greasy or oily rags or materials subject to spontaneous combustion shall be deposited and kept in approved receptacles for disposal.

On or before the completion of the Works, the Contractor shall carefully clean out all structures including pits, chambers and conduits and shall tear down and remove all temporary structures and facilities provided by him and shall remove rubbish of all kinds from any of the grounds which have been occupied or used and leave them in first-class condition approved by the Engineer.

17. MEASUREMENT AND PAYMENT

A. BONDS

Payment for bonds will be made at the lump sum price stipulated in the Schedule of Prices for Item A-1, which price and payment shall be full compensation for furnishing all bonds required by the Contract Documents.

B. INSURANCE

Payment for insurance will be made at the lump sum price stipulated in the Schedule of Prices for Item A-2, which price and payment shall be full compensation for furnishing all insurance required by the Contract Documents and as required by Federal, State and local agencies having jurisdiction over the Works.

C. MOBILIZATION AND PROJECT STARTUP

Payment for mobilization and project startup will be made at the lump sum price stipulated in the Schedule of Prices for Item A-3, which price and payment shall be full compensation for movement of all equipment, materials, plant and personnel to the Site and within the Site during performance of the Works; provision of all necessary permits; provision of all Contractor required facilities; provision of all required utilities; construction of access roads to work areas, including detours, where required; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 01121 - HEALTH AND SAFETY

### 1. GENERAL

#### A. GENERAL REQUIREMENTS

##### (1) Scope of Work

Work of this Section consists of the development, implementation and maintenance of a written Site-specific Health and Safety Plan.

The Contractor shall develop the Site-specific Health and Safety Plan prior to commencing any on-Site work and shall continue to implement, maintain and enforce the plan until final project closeout. The development, implementation and maintenance of the Site-specific Health and Safety Plan is the Contractor's sole responsibility. The Contractor's Site-specific Health and Safety Plan shall, as a minimum, address the specifications contained herein.

The health and safety guidelines contained herein are intended to provide for a safe and minimal risk working environment for on-Site personnel and to minimize the impact of activities involving contact with any hazardous materials or hazardous wastes on the general public and the surrounding environment.

Should the Contractor seek relief from or substitution for any portion or provision of the minimum health and safety guidelines specified herein or the reviewed Site-specific Health and Safety Plan, such relief or substitution shall be requested of the Engineer in writing, and if accepted by the Engineer, will be authorized in writing.

The Contractor is responsible for the safety of persons and property on the Site and for the protection of persons off the Site and the environment to the extent that they may be affected by the conduct of the Works. The Contractor shall comply with and enforce compliance by its employees and the employees of all of its Subcontractors, agents and invitees, with all safety requirements of the Contract Documents, all applicable federal, state and local statutes, regulations and ordinances, and with its Site-specific Health and Safety Plan. The Contractor acknowledges that safety and environment protection obligations are of paramount importance regarding all of the work performed under the Contract Documents.

##### (2) Basis

The Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 1926) shall provide the basis for the health and safety program. The program shall also reflect the position of the USEPA and NIOSH regarding procedures recommended or required to ensure safe operations at sites containing hazardous or toxic materials.

##### (3) Site Characterization

Work at the Site will involve contact with contaminated materials. A list of known chemicals at the Site as determined by USEPA is provided in the Trust's Health and Safety Plan for the Site which is included in Attachment B.

(4) Related Work Specified In Other Sections

The following items of work associated with the work of this Section are specified in other Sections as noted:

1. Provision of personnel support and hygiene facilities, Section 01500.

B. SUBMITTALS

(1) Contractor's Site-Specific Health and Safety Plan

Within (7) seven calendar days of the date of Notice to Proceed and prior to mobilization to the Site, the Contractor shall submit to the Engineer a Site-specific Health and Safety Plan for review. The submitted Site-specific Health and Safety Plan shall address, as a minimum, all aspects of worker protection and measures designed to prevent migration of hazardous or contaminated material to the environment, including but not limited to the provisions and guidelines contained herein. Specific topics which must be addressed in the Contractor's Site-specific Health and Safety Plan include:

1. worker medical surveillance;
2. worker training;
3. a detailed description of the planned movement of labor, equipment and materials from and between work areas as work progresses, including measures to be employed to prevent recontamination of previously cleaned areas and contamination of areas that do not now contain hazardous materials;
4. a detailed description of the personnel decontamination facilities to be employed including the planned phasing of decontamination facilities between work areas as work progresses and the methods to be used to collect, store, treat and ultimately dispose of personnel decontamination waters and wastes;
5. a detailed description of the washdown area for decontamination of vehicles and equipment and the methods to be used to collect, store, treat and ultimately dispose of washdown decontamination waters and sediments;
6. confined space entry program and procedures if the Contractor expects confined space work to be performed;
7. drum handling program in accordance with OSHA 29 CFR 1910.120(j) (for sites involving drum characterization activities);
8. personal protective equipment types to be used;
9. personal hygiene and personnel decontamination procedures;
10. respirator protection program and procedures;

11. personnel air monitoring;
12. emergency and first aid equipment and supply;
13. dust and particulate emission control; and
14. monitoring and mitigation of worker heat and cold stress.

The Contractor's Site-specific Health and Safety Plan must be submitted to and reviewed by the Engineer before the Contractor commences Site activities involving the handling or any contact with potentially hazardous waste.

The Engineer will review the Contractor's Site-specific Health and Safety Plan and provide comments to the Contractor within ten (10) days of receipt of the plan. The Contractor shall revise the plan as appropriate and resubmit the plan to the Engineer within seven (7) days of receipt of comments.

Work in the Exclusion Zone or in the Contaminant Reduction Zone (including any areas expected to become an Exclusion Zone or Contaminant Reduction Zone), including work relating to the designation or establishment of an Exclusion Zone or Contaminant Reduction Zone, may not commence until the Contractor's Site-specific Health and Safety Plan is reviewed by the Engineer, USEPA and OEPA. Other on-Site work may be conducted after the submittal of the Site-specific Health and Safety Plan to, and prior to, its review by the Engineer, but any such work shall be conducted only with the prior approval of the Engineer. The Contractor shall be obligated to implement the proposed Site-specific Health and Safety Plan, as submitted to the Engineer, USEPA and OEPA, during the conduct of any work performed prior to the review of the Site-specific Health and Safety Plan. The Trust's Health and Safety Plan for the Site as approved by USEPA is provided in Attachment B for the Contractor's review.

(2) Proof of OSHA Training

Within seven (7) calendar days of the date of Notice to Proceed and prior to mobilization to the Site, the Contractor shall submit to the Engineer a list of all personnel that will be employed throughout this Contract. For each of the listed personnel the Contractor shall provide proof of training for each employee as required under OSHA 29 CFR 1910.120. The Contractor shall submit to the Engineer proof of training for any additional employees, at least seven (7) calendar days prior to the employee's arrival on the Site.

(3) Medical Surveillance

Within seven (7) calendar days of the date of Notice to Proceed and prior to mobilization to the Site, the Contractor shall submit to the Engineer a report for medical examination conducted within the last twelve (12) months as part of compliance with OSHA medical surveillance requirements for each of the Contractor's personnel designated to be working on this Contract. As a minimum, the following information shall be submitted for each Contractor personnel:

1. name and Social Security Number and date of exam; and



2. physician's statement that the worker is approved to wear and use the types of respiratory protection proposed for the project and is able to work safely in hazardous environments capable of producing heat stress in the worker.

The Contractor shall submit to the Engineer reports on medical examination for any additional employees at least seven (7) calendar days prior to the employee's arrival on the Site.

C. JOB CONDITIONS

(1) Work Stoppage

The safety and health of the public and on-Site personnel and the protection of the environment shall take precedence over cost and schedule considerations for all project work. The Engineer and the Health and Safety Officer shall be responsible for decisions regarding when work shall be stopped or started for health or safety considerations and shall each have the authority to stop the work for health or safety considerations. The Health and Safety Officer shall have the obligation to stop the work when, in his discretion, it is necessary or advisable for reasons of health or safety.

(2) Unforeseen Hazards

Should any unforeseen or Site peculiar safety related factor, hazard, or condition become evident during the performance of the Works at the Site, it shall be the Contractor's responsibility to bring such to the attention of the Engineer verbally and in writing as quickly as possible, for resolution. In the interim, the Contractor shall take prudent action to establish and maintain safe working conditions and to safeguard employees, the public, the Owner, the Engineer and the environment.

2. HEALTH AND SAFETY OFFICER

The Contractor shall provide a Health and Safety Officer on the Site during the execution of all work. The Health and Safety Officer shall report directly to and be under the direction of a Certified Industrial Hygienist provided by the Contractor. The Certified Industrial Hygienist shall oversee operations as necessary to ensure the work is performed in accordance with the Site-specific Health and Safety Plan and shall oversee and be present during the Health and Safety Training Session and, as a minimum, complete qualitative respirator fit testing; and oversee the Health and Safety Officer's activities on a part-time basis and be available on an as-needed basis for emergency situations.

The Health and Safety Officer shall:

1. have a minimum of two years site-related working experience specific to the handling and excavation of contaminated soils;
2. have a sound working knowledge of State and Federal occupational safety and health regulations;
3. have formal educational and/or training in occupational safety and health;
4. be responsible for completing the health and safety training session;

5. be responsible for the implementation and daily enforcement and monitoring of the Site-specific Health and Safety Plan;
6. be responsible for performing air monitoring;
7. ensure that all on-Site personnel have obtained the required medical examinations prior to arrival at the Site and at the termination of their assignment as required;
8. be responsible for the pre-construction indoctrination of all on-Site personnel with regard to the Site-specific Health and Safety Plan and other safety requirements to be observed during construction, including:
  1. potential hazards,
  2. personal hygiene principles,
  3. use of personal protective equipment and respiratory protection, including fit testing, and
  4. emergency procedures for dealing with fire and medical situations;
9. be responsible for incorporating the provisions of both on-Site and off-Site emergency contingency plans in the Site-specific Health and Safety Plan and maintaining a state of readiness to enact the provisions;
10. be responsible for alerting appropriate on-Site and/or off-Site emergency services and the Engineer before starting any particularly hazardous work;
11. assist the Engineer in contacting and advising all local authorities of the Works being performed; and
12. have the authority and obligation to stop all, or any part of the Works if, in his sole discretion, stoppage of the Works is necessary or advisable for considerations of health or safety.

### 3. PERSONNEL HEALTH, SAFETY AND HYGIENE

#### A. MEDICAL SURVEILLANCE

The Contractor shall conduct medical surveillance of employees as required by 29 CFR 1910.120 and 29 CFR 1910.134.

The Contractor shall retain the services of a licensed occupational physician or physician's group to provide the medical examinations and surveillance required. All pertinent Site characterization data, a copy of 29 CFR 1910.120, and a description of the intended personal protective equipment shall be provided to the occupational physician prior to completing medical surveillance. The name of the physician and evidence of examination of all on-Site personnel shall be provided to the Engineer prior to assigning personnel on-Site work activities in the Exclusion Zone or Contaminant Reduction Zone. Contractor personnel medical approvals shall be maintained by the Contractor at the Contractor's Site office for the duration of the Contract.

Medical surveillance protocol shall be the occupational physician's responsibility but shall meet the requirements of OSHA standard 29 CFR 1910.120 and 29 CFR 1910.134 for all personnel. This exam may include:

1. medical/occupation questionnaire with work history;
2. full physical examination;
3. screening audiometric test with otoscopic exam for occlusion or perforation;
4. visual acuity measurement, including color perception;
5. pulmonary function test (Spirometry - FVC and FEV-1.0 second);
6. resting EKG;
7. chest x-ray;
8. blood chemistry profile as deemed appropriate by the attending physician for hazardous waste work;
9. complete blood count with differential and platelet evaluation, including WBC, RBC, HGB, hematocrit;
10. urinalysis with microscopic examination; and
11. other Site-specific medical monitoring as required by Site-specific conditions.

All on-Site personnel requiring full medical surveillance shall be provided with medical surveillance within the twelve (12) month period prior to entering the Site, and at any time there is suspected to be excessive exposure to toxic chemicals or physical agents. On-Site personnel who become due for an annual physical examination will be removed from the work force immediately until medical requirements are met in accordance with 29 CFR 1910.120 and 29 CFR 1910.134.

**B. TRAINING**

The Contractor shall provide and require that all personnel assigned to or entering the Site, complete Site training or refresher sessions. Site-specific training and refresher sessions shall ensure that all personnel are capable of and familiar with the use of safety, health, respiratory and protective equipment and with the safety and security procedures required for this Site. The training session shall be completed by the Health and Safety Officer provided by the Contractor under the supervision of the Contractor's Certified Industrial Hygienist.

The training program shall include, as a minimum, the following items:

1. names and personnel responsible for Site health and safety;
2. Site-specific potential hazards;
3. use of personal protective equipment (PPE), including proper donning and doffing procedures;
4. work practices by which the employee can minimize risks from these potential hazards;

5. confined space entry procedures (if confined space work is to be performed);
6. safe use of engineering controls and on-Site equipment;
7. discussion and completion of medical surveillance requirements and recognition of symptoms associated with exposure to hazards;
8. Site control methods;
9. on and off-Site contingency plans;
10. decontamination procedures;
11. Site-specific standard operating procedures;
12. delineation between work zones;
13. use of the buddy system;
14. scope of the intended work for the Contract;
15. review on-Site communications and appropriate hand signals between personnel working in the Exclusion Zone and/or Contaminant Reduction Zone; and
16. the content of the OSHA standards, including the Appendices.

In accordance with 29 CFR 1910.120, all employees assigned to or entering the Exclusion Zone or Contaminant Reduction Zone (including truck drivers transporting waste material) shall receive training including a minimum of 40 hours instruction off the Site and three (3) days of actual field experience under direct supervision of a trained experience supervisor and an 8-hour annual refresher. The Contractor shall provide documentation stating that all on-Site personnel expected to enter potentially contaminated work areas have complied with this regulation. Each individual's name shall be included on this confirmatory letter.

The Health and Safety Officer shall be responsible for ensuring that personnel not successfully completing the required training are not permitted to enter the Site to perform work in the Exclusion Zone or Contaminant Reduction Zone.

The Contractor shall implement a hazard communication ("Right-to-Know") program in accordance with 29 CFR 1910.1200.

C. **LEVELS OF PROTECTION**

Levels of protection for each work area shall be established based on planned activity, location of activity and air monitoring results. All potential exposures to hazardous materials shall be monitored with a photoionization device (Oxygen level meter and explosimeter for confined space work).

The level of personal protective equipment (PPE) required in the Exclusion Zone shall be minimum Level C until all wastes have been characterized. Following waste

characterization, the level of PPE may be increased or decreased, but will not be less than Level C for all waste handling activities.

The anticipated levels of personal protection based on work activity are as follows:

<i>Work Activity</i>	<i>Anticipated Level of Personal Protection</i>	<i>Contingency</i>
• Excavation of Contaminated Soils and Sediments, Relocation of East Pond Retaining Wall	C	B
• Installation of Pipe and Media Drain and Manholes, Dewatering of Ponds and Excavations	C	B
• Demolition Activities, Fencing	D	C
• Ditch Reconstruction, Final Soil Cover	D	C

#### D. PERSONAL PROTECTIVE EQUIPMENT

Based on the work activity and the anticipated level of personal protection as specified in Section 01121, Clause 3.C, the Contractor shall provide all on-Site contractor personnel with appropriate personal protective equipment (PPE). The Contractor shall ensure that all safety equipment and protective clothing is kept clean and well maintained. As a minimum, the Contractor shall supply each worker entering or expected to enter the exclusion zone or contaminant reduction zone with protection as specified in Section 01121, Clause 3.C, consisting of the following:

##### Level B

1. two piece, hooded, chemically resistant suite (saranex);
2. individually assigned open circuit, positive pressure Self-Contained Breathing Apparatus or Type C hoseline, with pressure/demand regulator with escape unit;
3. inner gloves, thin nitrile or latex;
4. chemically protective outer gloves;
5. boots, steel toe and shank;
6. disposable, chemical resistant overboots, butyl rubber or neoprene;
7. hard hats; and
8. working uniform complete with full length pants, long sleeve shirt, socks and underwear.

### Level C

1. individually assigned half-facepiece or full-facepiece air-purifying respirators (NIOSH approved), with appropriate cartridges for organic vapors and particulates. Respirators should be available at all times and donned when required as indicated by air monitoring;
2. chemical-resistant disposable coveralls (saranex);
3. latex and/or cotton inner gloves;
4. nitrile outer gloves;
5. work boots with steel toe and shank;
6. chemical-resistant overboots or booties, butyl rubber or neoprene;
7. hard hat; and
8. safety glasses and/or chemical-resistant goggles.

### Level D

1. hard hats;
2. safety glasses or goggles;
3. long pants and long sleeve shirt;
4. safety boots; and
5. any personal protective equipment necessary for specialized tasks (e.g. welding goggles).

Personal protective equipment usage procedures shall be developed by the Contractor. These requirements shall include, but not be limited to, the following:

1. all prescription eyeglasses in use on the Site shall be safety glasses. Contact lenses shall not be permitted on the Site within the Exclusion Zone or Contaminant Reduction Zone;
2. respirator cartridges/filters shall be changed daily during periods of respirator usage or upon breakthrough, whichever occurs first;
3. footwear used on the Site shall be steel-toed safety shoes or boots and shall be covered by rubber overshoes when entering or working in the Exclusion Zone;
4. all personal protective equipment worn on the Site shall be disposed or decontaminated at the end of the work day;
5. the Health and Safety Officer shall be responsible for ensuring all reusable personal protective equipment is decontaminated before being reissued;

6. on-Site personnel who have not passed a respirator fit test shall not be permitted to enter potentially contaminated work areas and/or the Contaminant Reduction Zone. Personnel shall not be permitted to have facial hair that interferes with a proper fit of the respirator; and
7. all on-Site personnel within active areas shall wear approved PPE including, but not necessarily limited to, hardhats and safety boots.

**E. RESPIRATORY PROTECTION**

All on-Site personnel shall receive extensive training in the usage and limitations of, and be qualitatively fit tested for, half- and full-facepiece respirators in accordance with 29 CFR 1910.134. This shall include both air purifying and supplied air type respirators.

The respirator program shall be developed and implemented by the Contractor and maintained by the Health and Safety Officer. A copy of the respirator program shall be incorporated or attached to the Contractor's Site-specific Health and Safety Plan.

The Contractor shall monitor, evaluate and provide respiratory protection for all on-Site personnel.

Levels of respiratory protection as listed in Section 01121, Clause 3.C have been chosen to be consistent with Site-specific potential airborne hazards associated with the major contaminants identified at the Site. The selection of appropriate protection is based upon the potential presence of compounds with the lowest recommended threshold limit value.

In the absence of additional air monitoring information or substance identification, the following minimum levels of respiratory protection will be required:

<i>Sustained Total Organic Vapor Concentration Above Background (ppm)</i>	<i>Level of Respiratory Protection Required</i>
0 - 1	Half- or full-facepiece respirator available
1 - 5	Half- or full-facepiece air purifying respirator, Level C
>5	Shut-down activities, evaluate the need for Level B or higher respiratory protection

The Contractor shall be responsible for appropriate respiratory protection during all work activities. As a minimum, the Contractor shall ensure that all persons entering the Exclusion Zone or Contaminant Reduction Zone are supplied with and use appropriate respiratory protection.

Assessing the ability for on-Site personnel to wear respiratory protection shall be the responsibility of the Contractor. Cardiopulmonary system examination and pulmonary function testing are minimum requirements and have previously specified in Section 01121, Clause 3.A.

On-Site personnel unable to pass a respirator fit test shall not enter the Exclusion Zone or Contaminant Reduction Zone. Proof of such fitting shall be provided to the Engineer prior to commencing work.

F. HEAT STRESS/COLD STRESS

The Contractor shall implement a heat stress and/or cold stress monitoring program as applicable. Specific components of the Contractor's program shall address:

1. training of employees to recognize and mitigate heat/cold stress situations and symptoms;
2. target conditions which will initiate monitoring of employees;
3. monitoring methods; and
4. the means and methods by which the Contractor will mitigate such conditions.

The Contractor shall base the heat stress/cold stress program on recommendations by ACGIH, NIOSH, and other recognized authorities.

G. PERSONNEL HYGIENE AND PERSONNEL DECONTAMINATION PROCEDURES

The Health and Safety Officer shall be responsible for, and ensure that all Contractor personnel observe and adhere to the personal hygiene-related provisions of this Section.

On-Site Contractor personnel found to be disregarding the personal hygiene-related provisions of the Site-specific Health and Safety Plan or the Project Specifications (including but not limited to the requirements concerning personal protective equipment specified in Section 01121, Clause 3.D; respiratory protection specified in Section 01121, Clause 3.E; and personnel hygiene and personnel decontamination procedures specified in Section 01121 Clause 3.G shall be issued a written notice of such violation. The notice may be issued by the Engineer, the Health and Safety Officer or any supervisory personnel of the Contractor. A copy of the notice shall be given to the offending worker, to his immediate supervisor, to the Contractor's Superintendent and to the Engineer. Upon issuance of a second written notice of such violation, the worker shall be terminated from employment at the Site.

Failure of the Contractor's supervisory personnel to implement this warning/termination provision shall be deemed a material breach of the Contract.

The Contractor shall provide, as a minimum, the following:

1. suitable containers for storage and disposal of used disposable PPE;
2. potable water and a suitable sanitation facility; and
3. shower and locker facility for all on-Site personnel.



The Contractor shall enforce the following provisions:

1. on-Site personnel shall wear appropriate PPE at all times when entering or working in the Exclusion Zone or Contaminant Reduction Zone;
2. used disposable PPE shall not be reused, and when removed, shall be placed inside appropriate containers provided for that purpose;
3. smoking, chewing nicotine products, eating and drinking shall be prohibited except in a designated lunch or break area;
4. soiled disposable outerwear shall be removed prior to entering the lunch area, and prior to cleansing hands;
5. on-Site personnel shall thoroughly cleanse their hands and other exposed areas before entering the smoking or lunch area;
6. all personnel working in the potentially contaminated work areas and/or Contaminant Reduction Zone shall shower and change to fresh clothing after each working period or shift, prior to leaving the Site;
7. used work clothing shall be laundered daily in a facility provided by the Contractor, at a location specified by the Engineer; and
8. water generated from washing and showering shall be stored in the designated wastewater storage tank in accordance with Section 01500.

Discarded disposable PPE shall be placed in Contractor-supplied sealable containers and stockpiled at the on-Site temporary stockpile area.

H. EMERGENCY AND FIRST AID EQUIPMENT AND SUPPLY

First aid equipment emergency first aid facility shall be located and maintained in appropriate locations as directed by the Health and Safety Officer. This equipment shall be stored on a portable pallet in order that it may be easily transported within the active work location. The required equipment shall include, at a minimum:

1. first-aid kit to accommodate on-Site personnel;
2. portable emergency eye wash and shower;
3. two 20-pound ABC type dry chemical fire extinguishers;
4. two self-contained breathing apparatus units (if confined space entry is to occur);
5. blankets and towels;
6. stretcher; and
7. one hand-held emergency siren.

As a minimum, the Contractor shall have one certified first aid technician on the Site at all times that work activities are in progress. This person may perform other duties but must be immediately available to render first aid when needed.

I. SITE COMMUNICATIONS

Emergency numbers shall be posted near Site telephones in accordance with the on-Site and off-Site Contingency and Emergency Response Plans.

Additionally, personnel shall work under the use of a "buddy" system and shall develop a hand signal system appropriate for Site activities.

An employee alarm system shall be provided to notify employees of on-Site emergency situations or to stop work activities if necessary.

Selected personnel shall be provided with two-way radios in accordance with Section 01500.

J. SAFETY MEETINGS

The Health and Safety Officer shall routinely conduct safety meetings as required which shall be mandatory for all Site personnel. The meetings shall provide refresher training for existing equipment and protocols, review ongoing safety issues and protocols and shall examine new Site conditions as they are encountered. Additional safety meetings shall be held on an as-needed basis.

K. CUSTODIAN

The Contractor shall employ and provide a custodian who shall be responsible for keeping all safety equipment and project facilities clean, properly equipped and maintained. The custodian may perform other duties for the Contractor but the custodian's first priority will be maintenance of protective equipment and the decontamination area. The custodian shall report directly to the Health and Safety Officer.

4. AIR MONITORING

A. AIR MONITORING PROGRAM

During the progress of work activities, the Contractor shall monitor air quality in and around the Exclusion Zone. Monitoring shall be conducted on a regular periodic basis, and additionally as required by special or work-related conditions. Any departures from general background shall be reported to the Engineer who will, in conjunction with the Health and Safety Officer, determine when operations should be shut down and restarted.

The Contractor shall provide the required instruments for air monitoring including, as a minimum, an organic vapor photoionizer or organic vapor analyzer and if confined space work is to occur, an oxygen level meter and an explosimeter. Additionally, personnel sampling pumps and dust monitors may be required if Site conditions warrant. The

Contractor shall provide sufficient numbers of each instrument to monitor the active work location and to provide backup equipment in cases of equipment malfunction.

Contractor air monitoring equipment shall be operated by Contractor personnel trained in the use of the specific equipment provided and shall be under the control of the Health and Safety Officer. All monitoring equipment used within the potentially contaminated work areas with combustible gases shall be intrinsically safe.

Air monitoring for organic vapors, shall be conducted on a routine basis around all active work locations. Monitoring shall be performed as a minimum on an hourly basis and additionally as dictated by Site activities.

Should the organic vapor level in any active working location exceed 50 ppm for any single reading, or 25 ppm for any two successive readings, or should the explosimeter indicate in excess of 10 percent of the Lower Explosive Limit (LEL) on any single reading, or reduced oxygen concentrations less than 19.5 percent oxygen, or if toxic gases and particulates are present in concentrations which present Immediate Danger to Life and Health (IDLH) or in excess of the protection factor afforded by the air purifying respirator (whichever is lower), then that work location shall be shut down and evacuated upwind. Work shall not resume at that work location until authorized by the Health and Safety Officer.

A wind direction indicator shall be provided and installed by the Contractor at each active work location.

**B. AIR MONITORING REPORTING**

The results of air monitoring programs shall be reported by the Contractor to the Engineer daily on specific forms and shall include the following information as applicable:

1. Site location/date;
2. work process/operation name;
3. temperature, wind speed and wind direction;
4. area sampling location diagram;
5. field notes including the following:
  1. description of operations and complaints/symptoms,
  2. chemicals/materials/equipment in use,
  3. engineering/administration controls in effect,
  4. personal protective equipment in use, and
  5. sampling observations/comments.

In addition, all daily air monitoring activities shall be recorded in a hard cover log book which shall be maintained on the Site at all times by the Health and Safety Officer.

**5. CONTINGENCY AND EMERGENCY RESPONSE PLANS**

**A. GENERAL**

Prior to mobilization to the Site the Contractor shall be required to prepare both on-Site and off-Site Contingency and Emergency Response Plans to ensure the safety of on-Site and off-Site personnel. The Contractor's on-Site and off-Site Contingency and Emergency

Response Plans shall be incorporated into the Contractor's Site-specific Health and Safety Plan.

**B. ON-SITE CONTINGENCY AND EMERGENCY RESPONSE PLAN**

The Contractor's on-Site Contingency and Emergency Response Plan shall address the standard operating procedures to be implemented during emergency situations. Emergency situations and responses to be addressed shall include, as a minimum, the following:

1. In the event of injury to on-Site personnel or contact with hazardous materials requiring immediate medical attention, the following protocol shall be followed:
  1. notify the Engineer and the Health and Safety Officer,
  2. phone the hospital previously identified to be closest to the Site and describe injury,
  3. decontaminate personnel and administer appropriate first aid, and
  4. transport personnel to the specified hospital along the most direct route which will be predefined prior to commencing Site work;
2. In the event that barrels or canisters are encountered during excavation, all work shall immediately cease and the Health and Safety Officer in conjunction with the Engineer shall determine appropriate modifications to the Site-specific Health and Safety Plan.
3. In the event that excessive gases or vapors are detected at an excavation, the following actions shall be taken:
  1. evacuate all workers to an area upwind from the effected area; and
  2. identify the contaminant and monitor contaminant concentrations to determine the type of respiratory protection and/or engineering controls required before workers re-enter the area;
4. In the event of a fire at an excavation, earth moving equipment shall be used to quickly backfill the area and smother the fire if possible and if the presence of noxious gases prohibits this, proper evacuation procedures shall be employed; and
5. In the highly unlikely event of a major leak of toxic gas, such as might occur if a compressed gas cylinder were encountered and ruptured during excavation, all on-Site personnel shall be evacuated to a safe distance, and the Police and Fire Department and local hospital notified if deemed necessary by the Engineer and the Health and Safety Officer. Police and Fire Department Officials will assume responsibility for coordinating with the Engineer and the Health and Safety Officer for the proper emergency response strategy upon arrival.

**C. OFF-SITE CONTINGENCY AND EMERGENCY RESPONSE PLAN**

Prior to commencing work involving the handling of hazardous materials, the Contractor shall develop an off-Site Contingency and Emergency Response Plan. This plan is

intended to provide immediate response to a serious Site occurrence such as explosion, fire or migration of significant quantities of toxic or hazardous material from the Site which could affect or endanger the public or adjacent public or private areas.

The Engineer shall be responsible for coordination of meetings with local officials, issuing minutes of meeting and preparation of the off-Site contingency and emergency response plan for distribution.

The Contractor shall attend a coordination meeting to be held with appropriate authorities which may include the City, Fire, Hospital, State and City Police, State Department of Transportation, the County Health Department and Civil Defense officials. The meeting shall identify the off-Site Emergency Response Coordinator through whom all information and coordination will occur in the event of an incident. Plans and procedures shall be developed, or existing plans and procedures adopted, for:

1. evacuation of Site adjacent areas;
2. fire fighting procedures;
3. transport of injured personnel to medical facilities;
4. priority transportation routes; and
5. coordination and/or modification of highway operations.

Techniques and recommended procedure for immediate first aid emergency response shall be developed by the Health and Safety Officer with local medical facilities.

6. SITE HEALTH AND SAFETY

A. WORK AREAS

The Contractor shall clearly lay out and identify work areas in the field and shall limit equipment, operations and personnel in the areas as defined below. These work areas may be established as temporary or permanent, depending on the work activity and the sequence in which it is performed. These areas are:

1. the Exclusion Zone which includes all areas where hazardous or potentially contaminated (soils, debris and other materials) are being, or may be contacted, disturbed or handled and all areas where contaminated equipment or personnel travel; Temporary Exclusion Zones shall be established around all remote work areas beyond the limits of the Exclusion Zone located within the Site fence and shall be clearly delineated in the field by temporary snow fencing and/or barricades supplied and installed by the Contractor;
2. the Contaminant Reduction Zone which shall occur at the interface of the Exclusion Zone and Clean Zone and shall provide for the prevailing upwind transfer of construction materials from clean to Site-dedicated equipment, the decontamination of equipment and vehicles prior to entering the Clean Zone, the decontamination of personnel and clothing prior to entering the Clean Zone, and for the physical segregation of the Clean and Exclusion Zones;
3. the Clean Zone which is defined as a clearly delineated predominantly upwind area outside the Exclusion Zone(s) and Contaminant Reduction Zone(s), which functions include:

1. an entry area for personnel, material and equipment to the Contaminant Reduction Zone;
2. an exit area for decontaminated personnel, materials and equipment from the Contaminant Reduction Zone; and
3. a storage area for clean safety and work equipment.

**B. TEMPORARY FENCING**

The Contractor shall erect temporary fencing on the Site to delineate work areas in accordance with the Site-specific Health and Safety Plan.

Temporary fencing shall be constructed of standard snow fence or construction fence supported by posts.

The Contractor shall coordinate the erection of temporary fencing with the work specified under other Sections of the Project Specifications. Prior to or during mobilization, the Contractor shall erect fencing to enclose the Exclusion Zone.

The Contractor may reuse existing temporary fencing. Temporary fencing to be reused or reset at another location shall first be decontaminated to the satisfaction of the Engineer.

**C. CONTAMINANT MIGRATION CONTROL**

The Contractor shall take appropriate measures to prevent the tracking of contaminants on and off the Site. Vehicles, equipment, and personnel leaving areas of potential contamination shall be decontaminated as determined by the Health and Safety Officer prior to entry into Clean Zones. The Contractor shall locate decontamination facilities and sequence work activities to prevent contaminant tracking.

Personnel engaged in vehicle decontamination shall wear protective equipment including suitable disposable clothing, respiratory protection and face shields.

**D. DRUM HANDLING PROGRAM**

Drums used during cleanup activities shall meet appropriate DOT, OSHA, USEPA and State regulations for the wastes that they contain. Drums shall be labelled as to content and date filled.

Site operations shall be coordinated so as to minimize the amount of drum or container movement. Drums shall be inspected prior to shipment and shall be staged so as to facilitate inspection.

Appropriate salvage drums shall be kept available and used in areas where spills or leaks may occur. A spill containment program shall be implemented to contain and isolate any and all of the hazardous substances being transferred.

Prior to commencing work involving handling of drums and other containers, the Contractor shall submit to the Engineer procedures for safe handling of drums and other containers in accordance with OSHA 29 CFR 1910.120 (j). During any activities involving

drummed waste characterization including but not limited to handling, opening, sampling, staging and consolidating, the Health and Safety Officer shall be responsible for and shall ensure that the drum handling program is implemented and enforced.

E. CONFINED SPACE ENTRY PROGRAM

(1) Responsibility

The Health and Safety Officer shall be responsible to ensure that minimum precautions as specified herein have been taken to assure safe entry of confined spaces, as stated in 29CFR 1910.146.

(2) Procedure

(a) Time Period Covered by Permits

Site personnel shall not enter any confined space without a written confined space work permit (see Appendix A for sample permit).

The confined space work permit will be valid for a single shift only. On jobs requiring more than a single shift to bring to completion, a new permit shall be completed at the start of each shift.

(b) Variances

1. Inability to Follow Procedure

Should any circumstances be found where these rules cannot be met, rules to insure adequate safety for entering these specific confined spaces must be written out by the Health and Safety Officer, for approval in accordance with the Health and Safety Plan. This variance shall detail any special conditions and shall be attached to the confined space work permit.

(c) Availability of Permit

Properly completed permits must be readily available at the Site. They must be kept on file indefinitely after the completion of the shift for which they were issued.

(d) Preparation of Equipment For Safety

Power must be de-energized, locked and tagged.

Every effort must be made to remove all hazardous contents from the confined space. Tests for flammable vapor and oxygen content must be taken on a continuous basis while anyone is in the confined space. If the tests do not meet the requirements of items (e)1. and (e)2, the workers must leave the confined space.

(e) Testing of Atmospheres Within Confined Spaces

1. Oxygen

Oxygen content must be above 19.5 percent and below 23.5 percent before entry will be allowed.

2. Flammable Vapors

Personnel shall leave confined spaces if the concentration of explosive gases exceeds 10 percent of the lower explosive limit (LEL). If hot work is to be conducted in the space, then explosive gasses cannot exceed 0% (LEL).

(f) Ingress and Egress

A safe means of ingress and egress, such as a portable ladder, must be kept in place at all times when personnel are occupying a confined space.

(g) Protective Clothing

Modified Level C protection shall be worn as a minimum by personnel entering confined spaces where the confined space has been made vapor free, meaning the vapor concentration is below the Threshold Limit Value (TLV) of the vapor being monitored, the total organic vapor readings are less than 5 ppm, the LEL is zero and the oxygen content is between 19.5 and 23.5 percent, and continuous air monitoring with a photoionization detector, oxygen meter and explosimeter is maintained. If all these conditions are not met, Level B protection shall be worn. The Site-specific Health and Safety Plan shall include a full confined space entry program.

(h) Life Lines

Means shall be provided for quick removal of individuals from confined spaces in emergencies. Where the least dimension of the access opening is less than 24 inches, wrist straps or noose-type wristlets shall be worn. Where the least dimension of the access opening is greater than 24 inches, either a life belt, safety harness, wrist straps or noose-type wristlets may be worn. In either case, a life line shall be attached and securely anchored outside the confined space.



(i) Illumination

Temporary lighting used in the confined space shall be of the explosion proof design with heavy duty cords and fittings and insulations maintained in good condition.

Portable (battery powered) lighting shall be operated at a maximum of 12 volts.

Portable (battery powered) lighting shall be kept at-the-ready outside of the confined space access opening to be used as illumination in the event of failure of the principle system. These lights shall be capable of providing illumination for a period of at least one hour.

(j) Safety Monitors

A person designated as a safety monitor shall be stationed at the access opening of any confined space while it is occupied. He/she must have continuous visual or verbal contact with occupants. One of his/her major responsibilities is to summon additional help in emergency situations.

In addition to the safety monitor, there shall be another person located within 100 feet of the confined space opening. This individual may do work other than that related to the confined space entry but it should not be such as to prevent his/her responding to a call for aid.

(k) Equipment Immediately Available to the Safety Monitor

The following emergency items shall be located at the access opening of the confined space or not more than 15 feet from such opening:

1. respiratory equipment as specified for Level B protection;
2. life lines, as described in item h above;
3. a battery powered portable light, as described in item (i). above; and
4. a portable type air-horn, capable of being heard 100 feet away over background noises.

7. MEASUREMENT AND PAYMENT

A. DEVELOPMENT, IMPLEMENTATION AND MAINTENANCE OF SITE-SPECIFIC HEALTH AND SAFETY PLAN

Payment for the development, implementation and maintenance of the Site-specific Health and Safety Plan will be made at the lump sum price stipulated in the Schedule of Prices for Item B-1 which price and payment shall be full compensation for the development and preparation of a Site-specific Health and Safety Plan; provision of all required training; provision of emergency first aid facilities; designation and maintenance of work areas; air monitoring for volatile organics, explosive gases and respirable dust; provision of a Personnel Hygiene/Decontamination Facility and Emergency First Aid Facility; provision of specified services; maintaining, cleaning and stocking the Personnel Hygiene/Decontamination Facility, the Emergency First Aid Facility, the toilet facilities, the Contractor's Office; and all other miscellaneous items for which separate payment is not provided under other Items.

As the Contractors selected to bid on this particular job are considered to be involved in hazardous waste activities on a full-time basis, the Contractor shall provide personnel who have already complied with the medical requirements as specified herein. Preliminary medicals for Contractor personnel shall not be included as a pay item. Additional medical surveillance required during the progress of the Works due to excessive exposure to toxic chemicals or physical agents shall be considered as an extra.

**B. PROVISION OF HEALTH AND SAFETY AND  
PERSONAL PROTECTIVE EQUIPMENT - LEVEL B**

**(1) Measurement**

Measurement for provision of health and safety and personal protective equipment - Level B will be made in mandays for the actual number of days per man wearing the specified protective equipment as determined by the Engineer from daily time sheets provided by the Contractor and submitted to the Engineer on a daily basis for approval.

**(2) Payment**

Payment for the quantity determined above will be made at the unit price per manday stipulated in the Schedule of Prices for Item B-2 which price and payment shall be full compensation for providing and maintaining personal protective equipment for Level B for all Contractor personnel required to work in the potentially contaminated work areas; and all other miscellaneous items for which separate payment is not provided under other Items.

**D. PROVISION OF HEALTH AND SAFETY AND  
PERSONAL PROTECTIVE EQUIPMENT - LEVEL C**

**(1) Measurement**

Measurement for provision of health and safety and personal protective equipment - Level C will be made in mandays for the actual number of days worked per man wearing the specified protective equipment as determined by the Engineer from daily time sheets provided by the Contractor and submitted to the Engineer on a daily basis for approval.

**(2) Payment**

Payment for the quantity determined above will be made at the unit price per manday stipulated in the Schedule of Prices for Item B-3 which price and payment shall be full compensation for providing and maintaining personal protective equipment for Level C for all Contractor personnel required to work in the potentially contaminated work areas; and all other miscellaneous items for which separate payment is not provided under other Items.

E. PROVISION OF HEALTH AND SAFETY OFFICER

1. Measurement

Measurement for provision of a Health and Safety Officer will be made at the actual number of days that the Health and Safety Officer works on Site, as determined by the Engineer from daily time sheets provided by the Contractor and submitted to the Engineer on a daily basis for approval.

2. Payment

Payment for the quantity determined above will be made at the unit price per day stipulated in the Schedule of Prices for Item B-4 which price and payment shall be full compensation for providing a qualified Site Health and Safety Officer including salary, wages, taxes and benefits; and all other miscellaneous items for which separate payment is not provided under other items.

F. PROVISION OF CUSTODIAN

1. Measurement

Measurement for provision of a Custodian will be made at the actual number of days that the Custodian works on Site, as determined by the Engineer from daily time sheets provided by the Contractor and submitted to the Engineer on a daily basis for approval.

2. Payment

Payment for the quantity determined above will be made at the unit price per day stipulated in the Schedule of Prices for Item B-5 which price and payment shall be full compensation for providing a custodian including salary, wages, taxes and benefits; and all other miscellaneous items for which separate payment is not provided under other items.

END OF SECTION

## SECTION 01300 - SUBMITTALS

### 1. GENERAL

Unless otherwise specified, drawings, product data and other technical information specified to be submitted by the Contractor to the Engineer shall be submitted in triplicate, consisting of one original and two copies. Copies shall be legible and shall clearly show all information contained on the original. Where Section 01300 or other requirements of the Project Specifications specify that submittals shall be prepared and sealed by a professional engineer, such professional engineer shall be licensed in the State of Ohio.

Where submittals are to be reviewed and approved by the USEPA and/or OEPA, final approval of such submittals and the schedule of any work upon which such approval is dependent are subject to review times of the USEPA.

### 2. CONTRACTOR'S CONSTRUCTION SCHEDULE

Within seven (7) calendar days of the date of Notice of Award and prior to commencing the Works at the Site, the Contractor shall submit a detailed construction schedule to the Engineer for review and approval. The Contractor's construction schedule shall show all activities required for construction of the Works in accordance with the construction schedule issued by the Engineer and identified in Section 01010 of the Project Specifications.

The schedule shall clearly show the proposed sequencing of the Works and the coordination of interrelated work activities and items. The proposed progress of the Works shall be shown on a weekly basis. The schedule shall, as a minimum, include each item of work identified in the Schedule of Prices as a work activity and identify the proposed start and completion date for each activity. The schedule shall be of sufficient detail to permit cross-referencing of items identified in other submittals. As a minimum, the schedule shall identify on a weekly basis: the size of the work force, anticipated man hours by trade, the type of equipment, the equipment hours for each type of equipment and demobilization. Actual progress of each activity of the Works shall be compared with progress indicated on the Contractor's Construction Schedule no less than once every month by the Contractor and such comparison shall be submitted to the Engineer for review.

If the Contractor believes it necessary or advantageous to change sequence of activities shown on the approved Contractor's construction schedule, he shall submit proposed revisions to the Engineer for approval. No change shall be made in order in which work activities are being performed until the Engineer's written approval for the revised schedule has been obtained.

### 3. CONSTRUCTION PROGRESS REPORTS

The Contractor shall submit weekly progress reports in a form acceptable to the Engineer indicating actual progress made the preceding week, showing cumulative progress toward scheduled completion, expressed as a percentage, of all items in the Contractor's construction schedule, number of workers and hours worked on the Site for each trade and the number and type of equipment and hours worked on the Site during the previous week. An updated schedule showing work tasks completed, any projected difficulties which may delay or alter the schedule and any modifications to the original schedule shall be included with the weekly progress report.

4. **CONSTRUCTION QUALITY CONTROL LOGS**

The Contractor shall record his daily quality control activities on a "Daily Construction Quality Control Report". All Site activities, Site inspections, submittals made by material suppliers and field testing of materials shall be recorded along with any unacceptable Site occurrences on a daily basis. The Daily Construction Quality Control Report shall be signed and reviewed by the Contractor and the Engineer at the completion of each work day. Attachment C presents an example of a typical Daily Construction Quality Control Report. The Contractor may use alternative forms providing the same information subject to the prior approval of the Engineer.

5. **CONTRACTOR'S DRAWINGS**

If specified, detailed drawings of material and structures to be supplied by the Contractor shall be prepared from typical details shown on "Approved for Construction" drawings and/or from specified requirements. Contractor's drawings shall be submitted to the Engineer for review and will be returned to the Contractor stamped and noted as being "Reviewed" by the Engineer before fabrication or construction commences.

All submittals shall bear the Contractor's approval stamp prior to their initial submission to the Engineer and shall be signed, dated and identified as to the specific project.

Dimensions shown on the Contractor's drawings shall conform with actual measurements of existing and/or completed associated structures and affected adjacent work.

Contractor's drawings shall indicate materials, methods of construction attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Works. Where articles or equipment attach or connect to other articles or equipment, the Contractor shall indicate that such work has been coordinated, regardless of the Project Specification Section under which the adjacent items will be supplied and installed. Contractor's drawings shall be cross-referenced to appropriate Project Specifications and Drawings.

The Contractor shall make changes in Contractor's drawings as the Engineer may require, consistent with the Contract Documents. When resubmitting drawings the Contractor shall notify the Engineer in writing of any revisions other than those requested.

Adjustments made on the Contractor's drawings by the Engineer are not intended to change the Contract Price. If adjustments affect the value of the Works, the Contractor shall state such in writing, as specified elsewhere in the Contract, to the Engineer prior to proceeding with the Works.

The Contractor shall submit three legible copies of drawings for each requirement requested in the Project Specifications and as the Engineer may reasonably request.

One print of each drawing will be returned stamped and noted as "Reviewed" by the Engineer, or marked up to show the Engineer's required modifications and noted as "Revise and Re-Submit". The Contractor shall correct and resubmit drawings as often as necessary until the Engineer returns drawings without marked modifications and stamped "Reviewed".

The Contractor shall not be relieved of any part of his responsibilities for correctness of his drawings or adequacy of his design bearing the Engineer's "Reviewed" stamp. The Engineer's

review is for the sole purpose of ascertaining conformance with general design concepts, and in no way constitutes approval of the detail design inherent in the Contractor's drawings, responsibility for which remains with the Contractor.

6. **MANUFACTURER'S PRODUCT DATA**

Where specified or as requested by the Engineer, the Contractor shall submit to the Engineer duplicate copies of product data sheets or brochures for requirements requested in the Project Specifications and as the Engineer may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

The Contractor shall also submit to the Engineer prior to a materials arrival on Site, Material Safety Data Sheet for all materials brought to the Site requiring special handling procedures.

7. **OPERATING AND MAINTENANCE MANUALS**

Where specified, the Contractor shall submit to the Engineer six (6) copies of operating and maintenance manuals. Operating and maintenance manuals shall be submitted and approved by the Engineer prior to Final Acceptance of the Works.

Operating and maintenance manuals shall contain operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and relevant maintenance information. Instructions in this manual shall be in simple language so as to guide the operator in the proper operation and maintenance of components.

The operating and maintenance manuals shall be bound in a three-ring hard covered binder approved by the Engineer.

In addition to information specified, the operating and maintenance manuals shall include the following information:

1. Title Sheet, labeled "Operating and Maintenance Instructions", containing project name and date;
2. list of names, addresses and telephone numbers of subcontractors and suppliers who can effect repair or maintenance on equipment supplied by the Contractor;
3. list of contents;
4. final shop drawings and product data of equipment;
5. Record Drawings of mechanical and electrical installation;
6. full description of system(s) and operation; and
7. other requirements as may be described in further detail in the Project Specifications.

8. **RECORD DRAWINGS**

After award of Contract, the Engineer will provide an extra set of Drawings to the Contractor for the purpose of maintaining record drawings during performance of the Works.

The Contractor shall accurately and neatly record deviations from the Contract Documents caused by Site conditions and changes ordered by the Engineer, on the extra set of Drawings.

Locations of concealed components of mechanical and electrical services also shall be recorded on the extra set of Drawings.

Such drawings shall be identified as "Record Drawings" and shall be maintained in new condition and made available for inspection on the Site, as required by the Engineer.

On completion of the Works and prior to final inspection, the Contractor shall submit record drawings and documents to the Engineer.

9. **SUBMITTALS FOR WEEKLY MEETINGS**

The following are minimum required submittals to be provided to the Engineer at least 24 hours prior to scheduled weekly meetings:

1. updated job progress schedules detailing all activities. Include review of progress with respect to previously established milestones and schedules, major problems and action taken, injury reports, equipment breakdown and all bulk material removal and all air sampling results conducted by the Contractor;
2. copies of all transport manifests, trip tickets and disposal receipts for all waste materials removed from the work area during the Works;
3. weekly copies of work-site entry logbooks with information on worker and visitor access.
4. weekly logs documenting filter changes on HEPA vacuums, and other engineering controls; and
5. weekly results of air sampling data collected during the course of the Works, including OSHA compliance air monitoring results.

10. **MEASUREMENT AND PAYMENT**

No separate measurement and payment will be made for work under Section 01300.

**END OF SECTION**

## **SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**

### **1. SITE OFFICES**

During the performance of the Works, the Contractor shall provide and maintain separate and suitable offices at the Site for the Contractor.

The offices shall be located on the Site as shown on the Drawings or as directed by the Engineer.

### **2. PERSONNEL HYGIENE/DECONTAMINATION FACILITY**

The Contractor shall provide, operate, and maintain a personnel hygiene/decontamination facility which complies with the requirements of 29 CFR 1910.141. The facility shall contain, as a minimum, the following:

1. shower facilities with at least one shower for every six (6) on-Site Contractor personnel;
2. locker room with one locker for each on-Site Contractor personnel plus three (3) additional lockers for use by the Engineer and regulatory agencies;
3. toilet facilities with at least one toilet and one hand basin for every six (6) on-Site Contractor personnel;
4. an on-Site room where personnel can eat, drink or smoke;
5. a room where all personnel safety equipment and protective clothing can be stored;
6. boot washing facility and boot rack for washed boots to drain; and
7. sanitary waste and wash water holding tanks and necessary pumping and piping from the Personnel Hygiene/Decontamination Facility to the wastewater tanks.

The Contractor shall connect the necessary pumping and piping to convey wastewaters from the shower facilities, boot washing facility, and hand basin to the designated wastewater storage tanks.

The Contractor shall sample and analyze containerized wastewater for disposal purposes. The analytical results shall be provided to the Engineer. The Engineer will determine if the wastewaters can be treated at the on-Site groundwater treatment facility or if they must be disposed of off Site.

The Contractor shall supply, install and connect separate holding tanks for the sanitary waste from the toilet facilities. The Contractor shall remove the contents of the sanitary waste holding tanks and discharge the wastes to a municipal sewerage system on a periodic basis as required and in accordance with governing regulations of authorities having jurisdiction.

The Contractor shall provide sufficient sanitary facilities for workers in accordance with governing regulations and ordinances.

The Contractor shall post notices and take such precautions as required by local health authorities.



The Contractor shall maintain the personal hygiene/decontamination facility and premises in a clean and sanitary condition and on completion of the Works shall remove the facilities and disinfect the premises.

3. **EQUIPMENT DECONTAMINATION FACILITY**

The Contractor shall utilize the existing equipment decontamination facility at the Site. The Contractor shall provide pumps and housing as required to remove decontamination wastewater to separate tankage at the existing on-Site groundwater treatment facility.

Equipment decontamination shall take place on the equipment decontamination facility and shall consist of degreasing, if required, followed by high pressure, low-volume, hot water or steam supplemented by detergents as appropriate.

Special attention shall be paid to removal of material on and within the tracks and sprockets of crawler equipment, and the tires and axles of trucks and rubber tire mounted equipment. The Contractor shall take measures to minimize the drift of mist and spray during decontamination. Such measures shall include the use of wind screens.

The decontamination wash unit shall be portable, high pressure with self-contained water storage tankage and pressurizing system. The unit shall be capable of heating and maintaining wash waters to 180°F and providing a nozzle pressure of 150 psi.

All decontamination waters shall be collected and transferred to the appropriate wastewater storage tank. Sediment accumulating in the decontamination sump shall periodically be collected and placed in the existing on-Site soil/sediment stockpile as directed by the Engineer. The Contractor shall supply and operate all equipment required to collect, contain and transfer decontamination wastewaters and sediments.

4. **EMERGENCY FIRST AID FACILITY**

The Contractor shall provide, operate and maintain an emergency first aid facility which complies with the requirements of 29 CFR 1910.141. This facility may be housed within or adjacent to the Personnel Hygiene/Decontamination Facility. The Emergency First Aid Facility shall have available, as a minimum, the following equipment and supplies:

1. stretcher;
2. one set of crutches;
3. two fire extinguishers meeting the requirements of 29 CFR 1910.307;
4. two self contained breathing apparatus units including full face masks;
5. one counter and sink with running potable water connected to the sanitary wastewater holding tanks;
6. one cot;
7. blankets and towels as required;

8. first aid kit containing medications appropriate for the initial treatment of burns, abrasions, fractures, and ingestion or dermal contact with on-Site hazardous waste;
9. one hand-held area siren/alarm;
10. two complete sets of enhanced USEPA Level B personal protective equipment; and
11. portable emergency eye wash and shower.

The Contractor shall keep at the Site at all times a sufficient number of fully equipped first aid kits for availability at each work location and shall post emergency and ambulance phone numbers in large letters beside each Site telephone.

5. PORTABLE TOILETS

The Contractor shall provide a minimum of two (2) portable sanitary toilets. The Contractor shall remove and dispose of sanitary wastes off Site on a periodic basis as required and in accordance with applicable laws and regulations. In lieu of portable sanitary toilets, the Contractor may provide toilets housed within the personnel hygiene/decontamination facility which are connected to separate collection tanks.

6. PARKING

Should off-road parking be required, the Contractor shall supply parking areas at its own expense.

The Contractor shall locate parking in a designated on-Site clean zone as shown on the drawings such that parked vehicles do not interfere with Site operations and/or adjacent facilities. The Contractor shall provide two parking spaces for the use of the Engineer.

7. ACCESS ROADS

The Contractor will be permitted reasonable use of all existing access roads at the Site subject to the following conditions:

1. traffic on roads or parking areas shall not be interrupted or interfered with at any time except where open-trench crossings have been specified on the Drawings and proper notice regarding open-trench crossings has been given to the Engineer; and
2. all vehicles comply with weight and load size restrictions where applicable.

Maintenance of access roads during performance of the Works shall include provision of all signs, barricades, gatepersons, flagpersons, flares and lights and other measures required. The Contractor shall provide flag persons for all construction traffic crossing or entering local traffic routes or otherwise required on the Site.

The Contractor shall take appropriate measures to prevent contamination of access roads and other clean areas during performance of the Works. Debris or material on access roads which is suspected to be contaminated as determined by the Engineer shall be scraped up, transported and placed by the Contractor into a designated area as directed by the Engineer. The

Contractor shall repair any wear and tear and damage to access roads arising out of the Contractor's construction operations.

8. **TELEPHONE**

The Contractor shall provide and pay for separate telephone service at the Contractors Site office for use by the Contractor. A radio telephone services will not be acceptable.

9. **ELECTRICAL POWER AND SITE LIGHTING**

The Contractor shall provide and pay for all power required for the performance of the Works, including provision of all necessary power distribution system and special connections to existing power system.

The Contractor shall supply, erect, operate and maintain adequate Site lighting to facilitate performance of the Works and to maintain a safe working condition. As a minimum, the Contractor shall provide outside area lighting in the office area and the decontamination area.

10. **POTABLE WATER**

The Contractor shall provide and pay for all necessary potable water, potable water holding tanks, distribution system and connections to a potable water supply. The Contractor shall maintain an adequate supply of potable water at the Site at all times.

11. **TEMPORARY HEATING**

The Contractor shall provide temporary heating, covering and enclosures as necessary to protect all work and material against damage by dampness, freezing and cold and to facilitate completion of the Works. The Contractor shall supply all fuel, equipment, materials and attendance required for temporary heating.

The Contractor shall be responsible for damage to the Works due to failure in providing adequate heat and protection during construction.

12. **GUARDRAILS AND BARRICADES**

The Contractor shall provide, erect and remove barricades and guardrails as required by laws and codes for the performance of the Works. Guardrails and barricades shall be erected in a timely manner around all excavations, open trenches and active work areas as shown on the Drawings and as directed by the Engineer. All excavations and work activity adjacent to Municipal, County or State roadways shall be guarded and barricaded to the standards and requirements of the respective Municipal, County or State maintenance authority as a minimum.

The Contractor shall ensure that all open excavations are flagged and barricaded prior to leaving the Site at the end of each work day.

13. DEWATERING

Except as specified otherwise, the Contractor shall dewater the various parts of the Works including, without limitation, excavations, structures, foundations and work areas.

The Contractor shall employ construction methods, plant, procedures and precautions that will ensure the Works, including excavations, are stable, free from disturbance and dry.

Construction methods may include but are not limited to: sheeting and shoring; groundwater control systems; surface or free water control systems employing ditches, diversions, drains, pipes and/or pumps; and any other measures necessary to enable the whole of the Works to be carried out in the dry. Before dewatering is started, the Contractor shall obtain acceptance by the Engineer for the method, installation and details of the dewatering system.

The Contractor shall provide sufficient and appropriate labor, plant and equipment necessary to keep the Works free of water including standby equipment necessary to ensure continuous operation of dewatering system.

The Contractor shall take precautions necessary to prevent uplift of any structure or pipeline and shall protect all excavations from flooding and damage due to surface runoff.

The Contractor shall control surface drainage including ensuring that gutters are kept open at all times, water is not directed across or over pavements or sidewalks except through approved pipes or properly constructed troughs and runoff from unstabilized areas is intercepted and diverted to a suitable outlet.

All surface water from potentially contaminated materials and groundwater shall be contained and transferred to the on-Site groundwater treatment system by the Contractor. The Contractor shall provide and operate suitable pumping equipment to pump excess water from the on-Site East pond to the on-Site groundwater treatment system at a controlled rate as directed by the Engineer to maintain the water level in the on-Site East pond below a specified level during performance of the Works.

14. SITE SECURITY

The Contractor shall provide Site security which as a minimum, shall include the following:

1. limit access to the Site to authorized vehicles and personnel only;
2. provide a list of authorized personnel and the name of their employer to the Engineer;
3. provide the Health and Safety Officer with radio communication to the Site office;
4. maintain a security log in which documentation is provided of all Contractor personnel, deliveries and any security incidents. This log shall include the date, name, address, company, time in and time out for each Contractor personnel. If unauthorized personnel are observed on the Site, the appropriate law enforcement officials shall be called upon for proper legal actions; and
5. check that the perimeter fencing and all warning signs are secure and intact on a daily basis. If deterioration of the Site security fence is observed, or if warning signs are found to be removed, the situation shall be brought to the attention of the Engineer and shall be immediately rectified by the Contractor.

In addition to the above, the Contractor shall provide temporary security fencing as shown on the Drawings or as required to maintain existing access restrictions to the Site. Temporary security fencing shall be supported by steel posts driven into the ground, to a depth sufficient to support the fence and minimum six (6) feet high. The post spacing and the fence mesh/fabric shall be suitable for the intended purpose. All Site access gates shall be locked at all times when there are no on-Site activities and shall be maintained in a closed position during active construction activities.

15. DUST AND PARTICULATE CONTROL

The Contractor shall supply and maintain dust control measures such as water misting systems as required to prevent generation of dust during performance of the Works. Water used for dust control shall be potable water, or treated water from the Trust's on-Site groundwater treatment facility, if available.

16. SOIL EROSION AND SEDIMENT CONTROL

The Contractor shall implement a soil erosion and sediment control plan as specified and as shown on the Drawings. All collected sediments shall be disposed of at one of the designated on-Site spoil areas as directed by the Engineer.

The Contractor shall maintain soil erosion and sediment control facilities during construction.

The Contractor shall stabilize the disturbed soils as quickly as practical. Stripping of vegetation, regrading or other development shall be done in such a way as to minimize erosion. The Contractor shall remove accumulated sediment resulting from construction activity from all adjoining surfaces, drainage systems and watercourses and repair any damage caused by soil erosion and sedimentation as directed by the Engineer.

17. WASTEWATER STORAGE FACILITIES

A. GENERAL

The Contractor shall provide, operate and maintain separate wastewater storage facilities to collect and store decontamination wastewaters and sanitary wastewaters. Wastewaters to be collected and stored in the wastewater storage tanks include wastewaters from the personnel and equipment decontamination facilities. Wastewater from toilets, handbasins, showers and laundry area shall be disposed of off Site as approved by the Engineer.

B. INSTALLATION

The Contractor shall install the facilities in the locations shown on the Drawings or as directed by the Engineer.

The Contractor shall connect all pumping, piping, miscellaneous items and necessary utilities as required for operation of the facilities. All tanks, valves, pumping, piping and miscellaneous items shall be protected from freezing.

C. OPERATION

The Contractor shall not operate the facilities until the Engineer has inspected the facility.

The Contractor shall operate the facilities and do all work necessary to collect wastewaters, including general maintenance and repairs when necessary.

The Contractor shall notify the Engineer 72 hours in advance of when a wastewater storage tank is anticipated to be full. The Contractor shall supply transportable tankage to remove stored liquids. The Contractor shall sample the liquids for disposal and have the sample analyzed to determine the final disposition of the wastewaters. Analytical results shall be submitted to the Engineer. The Contractor shall not discharge additional liquids to a filled tank following sampling by the Contractor. The Contractor shall transport and dispose of wastewaters at a facility as identified by the Contractor and approved by the Engineer.

18. PROTECTION OF MONITORING WELLS AND PIEZOMETERS

Monitoring wells and piezometers are located in the working area. The Contractor shall protect monitoring wells and piezometers and shall take all necessary precautions to avoid damage to these monitoring wells and piezometers. Any monitoring well or piezometer damaged by the Contractor during performance of the Works shall be repaired or replaced by the Contractor, as directed by the Engineer, at no additional cost to the Trust.

19. MEASUREMENT AND PAYMENT

A. SITE OFFICES

Payment

Payment for Site offices will be made at the lump sum price stipulated in the Schedule of Prices for Item C-1 which price and payment shall be full compensation for supply of all labor, plant, material and equipment required to supply, install and maintain the Contractor's, Site offices and lunch room area, furniture, filing cabinets, plan tables; telephone and facsimile service; and all other miscellaneous items for which separate payment is not provided under other Items.

B. PERSONNEL HYGIENE AND DECONTAMINATION FACILITIES

Payment

Payment for personnel hygiene and decontamination facilities will be made at the lump sum price stipulated in the Schedule of Prices for Item C-2 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required to supply, install, maintain, clean and stock personnel hygiene and decontamination facilities, emergency first aid facility, and toilet facilities; personnel hygiene and decontamination materials; toilets; wastewater and potable water holding tanks; maintenance of existing equipment decontamination facility; and all other miscellaneous items for which separate payment is not provided under other Items.

C. SITE SECURITY

(1) Measurement

Measurement for Site security will be made in days for the actual number of days Site security is supplied by the Contractor as measured by the Engineer and calculated from daily time sheets submitted by the Contractor.

(2) Payment

Payment for the quantity determined above will be made at the unit price per day stipulated in the Schedule of Prices for Item C-3 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required for provision of 24 hour Site security; supply and maintenance of security office and equipment at the entrance gate; and all other miscellaneous items for which separate payment is not provided under other Items.

D. SOIL EROSION AND SEDIMENT CONTROL

Payment for soil erosion and sediment control facilities will be made at the lump sum price stipulated in the Schedule of Prices for Item C-4 which price and payment shall be full compensation for supplying, constructing, maintaining and removing soil erosion and sediment control facilities; and all other miscellaneous items for which separate payment is not provided under other Items.

E. PROTECTION OF MONITORING WELLS AND PIEZOMETERS

Payment for protection of monitoring wells and piezometers will be made at the lump sum price stipulated in the Schedule of Prices for Item C-5 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for protection of monitoring wells and piezometers; and all other miscellaneous items for which separate payment is not provided under other Items.

No separate measurement and payment will be made for other construction facilities and temporary controls required for implementation of the Works.

END OF SECTION

## SECTION 01700 - PROJECT CLOSEOUT

### 1. GENERAL

The Contractor shall coordinate and perform project closeout activities in such a manner that no waste materials scheduled for off-Site disposal, or mobilized facilities remain at the Site upon completion of the Works.

### 2. FINAL DECONTAMINATION

The Contractor shall perform final decontamination of facilities, equipment, and materials which may have come in contact with potentially contaminated materials prior to removal from the Site. Decontamination shall be completed as described in the Site Specific Health and Safety Plan developed by the Contractor in accordance with Section 01121.

Decontamination shall be to the satisfaction of the Engineer. The Engineer shall have sole authority to approve decontamination as complete.

### 3. STORED WASTEWATER REMOVAL

The stored wastewater shall be sampled and analyzed for disposal purposes by the Contractor prior to disposal. The results of the analyses will determine the appropriate methods of disposal. Upon receipt of the analytical results and as directed by the Engineer, the tank contents shall be transferred by the Contractor to the Trust's on-Site water treatment facility for treatment by the Trust. Following emptying of the wastewater tank, the tank interior shall be decontaminated with a steam or high pressure water wash supplemented by detergent (Alconox). All rinse water generated as part of this cleaning shall be disposed of at the Trust's on-Site water treatment facility.

### 4. FINAL CLEANUP

The Contractor shall clean the Site of general litter and trash generated during the Works and leave the Site in a neat and orderly condition. The Contractor shall pick up any spilled imported fill. The Contractor shall remove and dispose of litter and trash to a sanitary landfill approved by the Engineer.

### 5. FINAL GRADING

All temporary roads constructed by the Contractor shall be removed and the affected surface restored to final grades and finished as approved by the Engineer.

### DEMOBILIZATION

The Contractor shall schedule and sequence demobilization activities such that all contaminated and potentially contaminated facilities, materials, and equipment to be removed from the Site can be decontaminated prior to removal.

Unless otherwise specified, the Contractor shall remove all waste materials, equipment, temporary structures and materials from the Site at the completion of the Works. The



Contractor shall disconnect and remove from the Site all temporary services and utilities required for the performance of the Works which were provided by the Contractor.

7. MEASUREMENT AND PAYMENT

A. DEMOBILIZATION AND PROJECT CLOSEOUT

Payment for demobilization and project closeout will be made at the lump sum price stipulated in the Schedule of Prices for Item D-1, which price and payment shall be full compensation for removal of all temporary fencing; disposal of all debris from the Site; decontamination of all equipment and vehicles, sampling, analysis and transfer of all wastewater to the on-Site water treatment facility; removal of all equipment and materials from the Site; regrading and restoration of disturbed or areas affected by the performance of the Works; final cleaning within all structures constructed by and used by the Contractor for performance of the Works; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 02099 - TRANSPORTATION AND OFF-SITE DISPOSAL

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of transportation and off-Site disposal as specified.

The work includes, but is not necessarily limited to, the following:

1. supply, operation and maintenance of transport vehicles/containers;
2. preparing for off-Site disposal and transporting the following waste materials:
  1. contents of Watson House,
  2. demolition debris from Watson House, and
  3. above ground portion of off-Site cleared and grubbed material;
3. securing non-hazardous materials in transport vehicles/containers and cleaning;
4. cleaning vehicles prior to leaving the Site;
5. transporting non-hazardous materials from the Site to approved disposal facilities;
6. obtaining all necessary permission and permits, and paying all necessary fees; and
7. disposing of non-hazardous materials at approved disposal facilities.

##### C. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

1. Site Preparation Section 02100;

#### 1.02 QUALITY ASSURANCE

##### A. General

The Contractor shall perform all acceptability testing of materials as required by and to the satisfaction of the operators of the disposal facilities, Federal, State and local regulations prior to transport from the Site. Sampling and analysis protocols shall be subject to the approval of the Engineer. Failure of the Contractor to sample and analyze materials shall not relieve the Contractor of the responsibility of ensuring that transported materials will be accepted by the disposal facility.

1.03 SUBMITTALS

A. General

The Contractor shall comply with Section 01300.

B. Transportation and Disposal Proposal

14 days prior to transportation and disposal of materials from the Site, the Contractor shall submit a proposal to the Engineer for transportation and disposal of the materials. The proposal shall include all relevant transporter and disposal facility identifications and status, methods of transportation and disposal, contingency plans for spills during transportation, and schedule for transportation and disposal.

C. Letters of Commitment

Prior to mobilization to the Site, the Contractor shall submit to the Engineer a copy of the letter of commitment from each and every proposed disposal facility. Each letter shall state:

1. that the facility is in compliance with specified requirements;
2. that the facility can and will accept the materials proposed for disposal at the facility;
3. any disposal facility restrictions which may cause rejection of transported materials;
4. any additional sampling and analysis of materials which are required prior to delivery to the facility; and
5. any restrictions on delivery schedules.

Each facility shall disclose information concerning any existing or imminent corrective action programs which may impact the ability of the facility to accept materials from the Site during performance of this Contract.

D. Agency Approvals

Seven (7) days prior to off-Site transportation of material, the Contractor shall submit to the Engineer, letters of approval from (USEPA) and applicable (State) agencies which approve the disposal of materials from the Site at each proposed disposal facility.

E. Operating Licenses and Permits

Prior to mobilization to the Site, the Contractor shall submit to the Engineer, copies of valid operating licenses and permits for each proposed disposal facility.

Seven (7) calendar days prior to transportation of materials from the Site, the Contractor shall submit to the Engineer, copies of operating licenses and permits for each proposed transporter as required by Federal, State, and local authorities.

**F. Transportation Routes**

Seven (7) calendar days prior to transportation of materials from the Site, the Contractor shall submit detailed plans showing the transportation routes which will be used to transport materials to each disposal facility. Transportation routes shall comply with applicable Federal, State, and local regulations.

**G. Manifests**

Copies of manifests shall be submitted to the Engineer on standard approved forms and shall include a copy of the manifest generated at the Site and a copy of the manifest signed by the receiving disposal facility.

Certificates of disposal issued by the facility shall be submitted to the Engineer following disposal.

**H. Weigh Scale Receipts**

Copies of weigh scale receipts shall be submitted to the Engineer on approved forms and shall be signed by the weigh scale operator or his designated agent and shall include the following:

1. location, date and time of weighing;
2. measured weights;
3. vehicle and container identification; and
4. shipment identification number.

**I. Test Results**

The Contractor shall provide the results of any analyses of material performed by and on behalf of the Contractor to the Engineer.

**1.04 JOB CONDITIONS**

The Contractor shall not spill, leak or otherwise release materials during transport which may cause nuisance.

The Contractor shall implement measures to suppress and control the generation of dust during handling and transportation operations. These measures shall include, but not be limited to, the use of water spray to suppress dust, the limiting of freefall of materials being loaded and the use of box covers for trucks carrying materials for disposal. Measures taken by the Contractor shall be subject to the Engineer's approval.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

Other material required for the work shall be selected by the Contractor subject to the Engineer's approval.

## 2.02 MATERIALS

### A. Polyethylene Sheeting

Polyethylene sheeting shall be continuous sheeting of minimum 0.006 inch (6 mil) thickness fabricated from a single ply of construction grade polyethylene plastic.

### B. Containers

Containers, packing material and labels shall comply with DOT, Federal State and local regulations.

## PART 3 - EXECUTION

### 3.01 PREPARATION

The Engineer may perform confirmatory sampling and/or analysis. The Contractor shall not remove materials from the Site which have been sampled by the Engineer and are awaiting analytical results. The Engineer will provide the analytical results to the Contractor upon request.

Any transported material delivered to facility which is rejected shall be returned to the Site. The cost of transporting materials from the Site to the facility and returning materials to the Site and the subsequent handling of the material on the Site shall be the Contractor's sole expense.

### 3.02 INSPECTION

The Contractor shall notify the Engineer sufficiently in advance of his intention to commence activities at the Site that requires attendance by the Engineer as provided hereinafter.

Activities requiring attendance by the Engineer include, but are not necessarily limited to, the following:

1. placement of polyethylene sheeting in transport vehicles/containers;
2. final securement of loaded materials prior to transport from the Site; and
3. decontamination of transport vehicles/containers prior to leaving the Site.

The Contractor shall not cover up any loaded material prior to the Engineer's inspection.

### 3.03 PERFORMANCE

#### A. Segregation of Materials

The Contractor shall segregate materials for disposal in accordance with the delivery requirements of the disposal facilities for which the materials are destined.

**B. Preparation of Transport**

**(1) General**

Transport vehicles and/or containers delivered to the Site for the transport of waste shall comply with all applicable Federal, State and local regulations concerning transport of waste materials and shall have all required Federal and State licenses and permits prior to delivery.

In addition, each transport vehicle and container shall be numbered and the number visibly displayed.

**(2) Securing of Waste Materials**

All waste materials shall be secured in transport vehicles and/or containers in accordance with the regulations governing the transporting of these materials.

The Contractor shall clean the receiving box of the transport vehicle or container of any loose debris or foreign material. The receiving box or container shall be lined with one layer of polyethylene sheeting. Each layer shall be continuous along the bottom and sides. The sheeting shall be placed on the floor, run up the sides and draped over the sideboards. The polyethylene sheeting shall be neatly pushed into corners to prevent tearing during loading and transport. Materials shall be loaded into transport vehicles or containers in a manner which will not damage the properly placed polyethylene sheeting. The Contractor shall limit the freefall of any bulk materials being loaded. The Contractor shall place cushioning materials under and around each container for shipments of drummed/containerized materials. Damaged sheeting which is incapable of providing containment, as determined by the Engineer, shall be replaced at the Contractor's expense. Following loading, the Contractor shall fold the tub liner over the loaded materials and place an overliner of polyethylene sheeting over the materials prior to securing with an approved tarpaulin in such a way to prevent loss of materials or fugitive dust emissions.

The Engineer will waive the lining requirements where the Contractor can demonstrate, to the satisfaction of the Engineer, that all of the following conditions are met:

1. the receiving box or container is of leak-proof construction and capable of maintaining a leak-proof condition;
2. the cover to be placed over the receiving box or container is impermeable and will totally enclose the materials within;
3. the cover to be placed over the receiving box or container will prevent fugitive dust emissions; and
4. the receiving box or container is constructed of materials which can be decontaminated.

**(3) Decontamination**

Transport vehicles and containers shall be decontaminated after loading and prior to leaving the Site. Special attention shall be paid to the removal of material on

the tires and axles of trucks and material on the vehicle resulting from loading operations.

(4) Manifesting of Contaminated Materials

The transport of waste materials to off-Site facilities shall be documented on appropriate State and/or Federal manifests as required. The Contractor shall prepare and provide the Engineer with copies of manifests and/or other records for each shipment of waste materials from the Site. The Contractor shall be responsible for maintaining manifests from the time the waste materials leave the Site to the time of release to the disposal facilities.

(5) Notification

The Contractor shall notify all applicable Federal, State and local representatives of authorities having jurisdiction over the route and mode of transport in advance of commencing transportation.

C. Pre-Transport Weighing

The Contractor shall weigh transport vehicles with and without loaded materials at an approved weighing site. Weighing operations shall be performed in such a manner that the net weight of loaded materials can be determined to the satisfaction of the Engineer.

The net weight shall be reported verbally to the Engineer and verbal approval granted from the Engineer prior to commencing transport to the disposal facility. Transport vehicles may be instructed by the Engineer to return to the Site following weighing if loads are determined to be excessively light or heavy.

Written weigh scale receipts shall be submitted to the Engineer within 24 hours of weighing and shall agree with the verbally reported quantity.

D. Transportation

All waste streams generated at the Site shall be transported by the Contractor directly from the Site to the disposal facility approved by the Engineer. The Contractor shall not change either the route or mode of transport after commencing off-Site operations without the Engineer's written approval.

The Contractor shall comply with the applicable requirements of regulatory publications which include, but are not limited to, the following:

1. 40 CFR 262 - Standards Applicable to Generators of Hazardous Waste;
2. 40 CFR 263 - Standards Applicable to Transporters of Hazardous Waste;
3. 49 CFR 171 - General Information Regulations and Definitions;
4. 49 CFR 172 - Hazardous Materials Tables and Hazardous Materials Communications Regulations;
5. 49 CFR 173 - Shippers General Requirements for Shipments and Packaging;
6. 49 CFR 174 - Carriage by Rail;

7. 49 CFR 174 - Carriage by Water; and
8. 49 CFR 177 - Carriage by Public Highway.

Transport vehicle operators shall be trained in conformance with Federal, State and local regulations for non-hazardous waste haulers.

E. Disposal

1. General

The Contractor shall make all arrangements with disposal facilities for the receipt and acceptance of waste materials removed from the Site unless otherwise specified.

The Contractor shall be responsible for and shall do all work necessary to ensure that waste materials removed from the Site are properly prepared and will be accepted by the disposal facility. The Contractor shall dispose of waste materials in disposal facilities approved by the Engineer, USEPA and OEPA which are in compliance with all applicable regulations:

The Contractor shall weigh transport vehicles/containers at approved off-Site disposal facility weigh scales both before and after discharging their contents, and shall provide copies of records of weights and calibration certificates to the Engineer. Weight measurements shall be of a comparable precision and accuracy to those taken for completion of waste shipment manifests.

Such measurements will be used by the Engineer to verify proper delivery of waste materials which have been removed from the Site and delivered to approved disposal facilities.

2. Disposition of Materials

The Contractor shall select and submit proposals to the Engineer for the appropriate disposition of all non-hazardous materials removed from the Site in accordance with applicable regulations. The Contractor shall be responsible for disposition of materials to approved off-Site disposal facilities.

Non-hazardous, uncontaminated and decontaminated materials shall be disposed of at a sanitary landfill or scrap yard.

The Contractor shall not load materials for transport for disposal without the Engineer's approval.

G. Sanitary Landfill

The Contractor shall dispose of demolition and clearing and grubbing debris at a sanitary landfill approved by the Engineer.

The facility shall be permitted to receive solid wastes, other than hazardous wastes, by EPA and/or all other authorities having jurisdiction.



The Contractor shall prepare a report for each shipment of waste materials to the sanitary landfill. The report shall be provided to the Engineer no later than the next working day following each day's shipment. The report shall contain as a minimum:

1. the total weight of wastes shipped,
2. a description of wastes shipped, and
3. a receipt signed by the landfill operator showing the weight of waste material received in each shipment, the date and time of day each load is discharged, and a brief description of the waste materials.

#### 3.04 ADJUSTMENT AND CLEANING

The Contractor shall cleanup any and all spills or leaks in transit.

#### PART 4 - MEASUREMENT AND PAYMENT

Measurement and payment for transportation and disposal of waste materials is included under the pay items of Section 02100.

END OF SECTION

## SECTION 02100 - SITE PREPARATION

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of Site preparation as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. clearing and grubbing trees, hedges, weeds, debris, stumps, vegetation and other plants in designated areas of proposed capping;
2. removal of existing fencing;
3. demolition of Watson house;
4. demolition of existing buried piping;
5. removal and disposal of demolition debris and cleared and grubbed debris;
6. dewatering of East Pond; and
7. relocation of East Pond retaining wall.

##### B. Related Work Specified in Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

1. Construction Facilities and Temporary Controls, Section 01500; and
2. Excavation of contaminated soils and sediments, Section 02220.

#### 1.02 JOB CONDITIONS

##### A. Existing Conditions

The Watson house in Grid 1-9 is located in a contaminated surficial grid square. Prior to demolition of the Watson house, the top two feet of soil shall be removed and stockpiled on the Site at the contaminated soil staging area.

Areas not required to be cleaned and grubbed shall be left as is in order to minimize erosion.

All stormwater from rainfall events on the Site presently drains into and is contained by the on-Site East and West Ponds. During construction of the Works, all stormwater on the Site must be contained and diverted to these on-Site ponds.

The existing East Pond retaining wall falls within the work area and will have to be relocated by the Contractor as specified herein.

Results of soil borings investigations conducted at the Site by the Trust in 1991 are included in Attachment C for the Contractor's review.

**B. Environmental Requirements**

The Contractor shall suppress and control the generation of dust and particulate emissions at all times in accordance with Section 01500 and Section 01121.

**C. Protection**

The Contractor shall protect fencing, monitoring wells, piezometers, extraction wells, benchmarks, pavement, utility lines, Site appurtenances, trees, root systems of trees, shrubs, plants and other features not required or specified to be cleared or removed.

The Contractor shall prevent accidental fires and fire damage and shall take fire protection measures necessary to meet requirements of authority having jurisdiction, including provision of fire-fighting equipment on standby at all times.

During demolition activities the Contractor shall prevent movement, settlement or damage of adjacent areas, structures, services, utilities, adjacent grades to remain or any other item not specified to be demolished.

**D. Sequencing and Scheduling**

The Contractor shall schedule the demolition of the Watson House to commence after removal of the top two feet of contaminated soil from Grid 1-9.

The Contractor shall relocate the South Drainage Ditch prior to installation of the pipe and media drain and manholes.

**1.03 SUBMITTALS**

**A. General**

The Contractor shall comply with Section 01300.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

The Contractor shall supply all materials and equipment necessary or required for performance of clearing and demolition operations.

Other materials shall be selected by the Contractor subject to the approval of the Engineer prior to use.

## 2.02 MATERIALS

### A. Polyethylene Sheeting

Polyethylene sheeting shall be reinforced continuous sheeting of 0.006-inch (6-mil) thickness fabricated from a single ply of polyethylene plastic, in widths and lengths suitable to minimize joints and overlapping.

## PART 3 - EXECUTION

### 3.01 PREPARATION

The Contractor shall notify the Engineer prior to commencing clearing and grubbing operations. Dust suppression systems and the soil erosion and sediment control measures as specified shall be in place before commencing with clearing and grubbing operations.

### 3.02 PERFORMANCE

#### A. Clearing and Grubbing

The Contractor shall clear and grub all vegetation including trees, stumps, grass, debris, rubbish, down timber, logs, brush, undergrowth, hedges in designated areas of proposed remedial construction activities.

All below ground portions of trees and shrubs and aboveground portions of trees and shrubs on Site shall be cut and/or broken into manageable size pieces, transported to and disposed in designated on-Site spoil areas. All material disposed at the on-Site spoil area shall be compacted in the spoil area in layers not exceeding 12 inches.

All off-Site aboveground portions of trees, shrubs and other cleared vegetation shall be stockpiled separately from portions of trees, shrubs, down timber and other material in contact with or below the surface of the ground and shall be disposed of at a sanitary landfill selected by the Contractor and approved by the Engineer.

The Contractor shall take special care to ensure that the aboveground portions of trees, shrubs and other cleared vegetation do not come in contact with contaminated material.

Locations for and methods of stockpiling shall be suitable for minimizing accidental fires and fire damage and shall be approved by the Engineer.

#### B. Demolition and Removal

##### (1) General

The Contractor shall demolish and remove structures from locations shown on the Drawings. In terms of demolition and removal of concrete slabs and foundations, the Contractor shall remove such structures that interfere with the final design grades, lines and elevations or are within the zone to be occupied by final soil cover.

Concrete structures not requiring removal shall be fractured and left in place in a manner to allow free groundwater movement after construction of the final soil cover.

The Contractor shall carefully break concrete within specified demolition limits by mechanical means using air tools, hydraulic tools, drilling and wedging, or any other means approved by the Engineer. Blasting will not be permitted.

Demolition debris shall be broken or otherwise cut into sizes suitable for transportation and disposal.

The Contractor shall load demolition debris directly into approved haulage units for transportation and disposal as specified or as directed by the Engineer. Loading shall be performed in such a manner as to suppress and control dust generation and to maintain the loading area adjacent to the excavation or demolition area in a neat and tidy manner.

The Contractor shall backfill in locations as directed by the Engineer. The Contractor shall backfill with approved native and/or imported fill material in layers not exceeding 6 inches after compaction, to 90 percent of maximum dry density as determined in accordance with ASTM D698.

On completion of structure removal and prior to backfilling, the Contractor shall obtain approval from the Engineer to proceed with backfilling.

The Contractor shall comply with the dewatering requirements of Section 01500.

(2) Fencing

The Contractor shall remove existing fencing within limits shown on the Drawings as required for access to work areas, or as directed by the Engineer.

Existing fence shall be dismantled in place including posts, rails, mesh and gates. The fence posts and post footings, rails, mesh and gates shall be removed and stockpiled on Site for later reuse.

The Engineer will inspect all excavations following fence and footing removal. Post holes shall be backfilled with common fill after inspection and approval by the Engineer.

All excavated soil material shall be used to backfill the postholes.

(3) Storm Sewer

The Contractor shall excavate and crush sections of existing storm sewer piping as shown on the Drawings.

(4) Watson House

The Watson House shall only be demolished after two feet of contaminated soil has been removed from Grid 1-9, and the resulting excavation backfilled with clean imported loam material as specified in Section 02264. Prior to demolition of the house, the Contractor shall remove and dispose of the contents of the house at a sanitary landfill selected by the Contractor and approved by the Engineer. The Contractor shall arrange for all utility locates and disconnections prior to commencing soil removal and/or demolition activities.

The Contractor shall demolish the existing Watson House and dispose the resulting demolition debris off Site at a sanitary landfill selected by the Contractor and approved by the Engineer. All aboveground parts of the house and the top two feet of the house below ground level shall be razed to existing grade level and disposed off Site. Remaining foundations, concrete slabs, below grade basement or concrete structures, shall be fractured and left in place. The Contractor shall backfill the work area affected by the demolition operation with clean imported fill and six inches of imported topsoil and shall finish surface to established grade as approved by the Engineer. The topsoil shall be seeded, fertilized, watered and maintained as specified in Section 02900.

(5) Relocation of East Pond Retaining Wall

The East Pond retaining wall shall be relocated as shown on the Drawings to provide adequate working space for installation of the pipe and media drain, manholes and access road. All water generated from dewatering of the pond shall be transferred to the West Pond after closing the West Pond overflow pipe. Should the West Pond be full as determined by the Engineer, excess water generated from dewatering of the East Pond shall be treated at a maximum of 20 gallons per minute in the on-Site water treatment facility. Additional treatment of pond water as required by the Contractor shall be provided by the Contractor. All treated water discharged from the Site shall comply with the water discharge limitations for the Site. All dewatering equipment and forcemains shall be provided, maintained and operated by the Contractor.

After dewatering of the East Pond, the Contractor shall excavate the top two feet of pond sediments from the area of the pond affected by the retaining wall relocation, and transport and stockpile the removed sediment at the on-Site contaminated soil staging area as shown on the Drawings and as directed by the Engineer. All material stockpiled at the contaminated soil staging area shall be covered with 6-mil polyethylene sheeting which shall be adequately secured in place.

The Contractor shall use material from the existing pond retaining wall, existing on-Site soil stockpiles, or imported common fill, as approved by the Engineer, for construction of the new pond retaining wall, and shall compact all material in the relocated pond wall to 95% of maximum dry density.

The steel pipe in the existing East Pond wall shall be removed and stockpiled on Site at the debris stockpile as directed by the Engineer. The granular activated carbon bed in the existing East Pond wall shall be excavated and stockpiled with the pond sediments at the contaminated soil staging area.

PART 4 - MEASUREMENT AND PAYMENT

4.01 CLEARING AND GRUBBING

A. Measurement

Measurement for clearing and grubbing will be in acres for the actual number of acres cleared and grubbed as determined by the Engineer and calculated from the horizontal projection of the area cleared and grubbed.

**B. Payment**

Payment for the quantity determined above will be made at the unit price per acre stipulated in the Schedule of Prices for Item E-1 which price and payment shall be full compensation for supply of all labor, equipment, plant and materials necessary to carry out clearing and grubbing activities; cutting and placing designated cleared and grubbed materials in on-Site spoil areas as directed by the Engineer; disposal of designated cleared and grubbed materials at an approved off-Site sanitary landfill; excavation and crushing of storm sewer piping; and all other miscellaneous items for which separate payment is not provided under other Items.

**4.02 REMOVAL OF FENCING**

**A. Measurement**

Measurement for removal of fencing will be in lineal feet for the actual number of lineal feet of fence removed as measured in place by the Engineer along the centerline of fence continuous through gates and posts.

**B. Payment**

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item E-2 which price and payment shall be full compensation for removing existing fence; removal of posts, rails, mesh, footings and gates; loading, transportation and stockpiling of fencing; backfilling of post holes; and all other miscellaneous items for which separate payment is not provided under other Items.

**4.03 DEMOLITION AND REMOVAL OF WATSON HOUSE**

Payment for demolition and removal of the Watson house will be made at the lump sum price stipulated in the Schedule of Prices for Item E-3 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to demolish the Watson house; dismantle/remove/plug utilities and services; removal and disposal of house contents; fracturing of below grade slabs and walls; excavation and backfill; dust suppression and controls; working and handling debris; loading demolition debris into haulage units; transportation and off-Site disposal of demolition debris and house contents; and all other miscellaneous items for which separate payment is not provided under other Items.

**4.04 RELOCATION OF EAST POND RETAINING WALL**

Payment for relocation of the East Pond retaining wall will be made at the lump sum price stipulated in the Schedule of Prices for Item E-4 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to relocate the East Pond retaining wall; dewater East Pond and transfer pond water to West Pond and/or to on-Site water treatment facility, provision of additional treatment for pond dewatering operations; construction of new East Pond retaining wall; and all other miscellaneous items for which separate payment is not provided under other Items.

**END OF SECTION**

## SECTION 02220 - EXCAVATING AND BACKFILLING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of excavating and backfilling as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. excavating and trenching as required for installation of the forcemains, conduits and pull boxes, pipe and media drain trench, wet well and access manhole structures;
2. backfilling completed installations and regrading to pregrade elevations;
3. excavating, hauling and temporary stockpiling contaminated soil and sediment material at on-Site contaminated soil staging area;
4. excavating, hauling, placing and compaction of non-degraded soil material for construction of drainage ditch and work area grading;
5. work area grading to subgrade of final soil cover system;
6. supply and installation of clean imported fill as required;
7. construction of access road; and
8. relocation of the South drainage ditch and reconstruction of the east drainage ditch.

##### B. Related Work Specified in Other Sections

The following items of work related to the work of this Section are specified in other Sections as noted:

- |   |                          |
|---|--------------------------|
| 1. Construction of final soil cover       | Sections 02264 and 02900 |
| 2. Relocation of East Pond retaining wall | Section 02100            |

##### C. Terminology

Backfill means the material placed from the top of the pipe and/or the bedding to the subgrade for restoration work.

Excavation, stockpiling and trenching shall mean the removal, segregation and temporary storage of all materials of whatever nature encountered in the Works whether wet, frozen or otherwise and may include boulders, weathered rock, partially cemented



materials, concrete, pavements and rock which can be removed by ripping or heavy duty mechanical excavation equipment without drilling and blasting.

Grading shall mean surface contouring and shaping for grade control and to control surface water runoff prior to installation of final soil cover.

## 1.02 QUALITY ASSURANCE

### A. General

The rules of OSHA and the State Department of Labor with respect to excavation and construction shall at all times be strictly observed.

Material excavated from the Works will be judged suitable or unsuitable for backfilling by the Engineer in accordance with specified requirements for excavated material to be used as backfill in the Works.

Excess or unsuitable excavated material shall not be removed from the Site.

### B. Source of Materials

The Contractor shall inform the Engineer of source of materials to be incorporated into the Works and shall provide access to the source and processed material for the purposes of sampling and testing prior to delivery to the Site. The Contractor shall provide the Engineer with sufficient documentation showing the source of materials complies with the specified requirements for the use of the material.

If in the opinion of the Engineer, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, the Contractor shall obtain an alternate source or demonstrate that material from the source in question can be processed to meet specified requirements.

Should a change of material source be proposed during the Works, the Contractor shall advise the Engineer sufficiently in advance of proposed change to allow sampling and testing.

Acceptance of a material at source or failing conduct of sampling and testing at source by the Engineer does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

The Contractor shall bear the cost of sampling and testing of materials which fail to meet specified requirements.

## 1.03 SUBMITTALS

### A. General

The Contractor shall comply with Section 01300.

**B. Source**

The Contractor shall advise the Engineer of the location of the proposed source of all imported soils at least 14 days prior to commencing transport of materials to the Site, including any change in material source during performance of the Works. The Contractor shall submit grain size distribution curves for each material source to the Engineer at least 14 days prior to transporting the material to the Site.

**C. Geotechnical Data**

The Contractor shall provide the Engineer the grain size distribution curves for each classification of material prior to its installation.

**D. Excavation Plan**

Prior to commencement of excavation activities, the Contractor shall submit a detailed Excavation Plan to the Engineer for review to ascertain compliance with the requirements specified.

The Excavation Plan shall, as a minimum, address each of the following items:

1. the methods and procedures which will be used to perform excavations;
2. the sequencing of excavation and backfill activities; and
3. the methods and procedures which will be implemented to prevent contaminant tracking and cross-contamination.

**1.04 PRODUCT DELIVERY AND HANDLING**

**A. Delivery**

The Contractor shall handle and transport materials at all times in a manner and with equipment that will avoid segregation or contamination of the fill material.

**B. Storage and Handling**

When necessary, as approved by the Engineer, the Contractor shall stockpile material on the Site in locations designated by the Contractor and approved by the Engineer.

The Contractor shall ensure and provide that stockpile sites are level, well drained, free of foreign materials, and of adequate bearing capacity to support the weight of the materials to be placed thereon. Stockpiles shall be either far enough apart or separated by substantial dividers to prevent intermingling.

Except where material is stockpiled on acceptably stabilized areas, the Contractor shall provide a suitable base to prevent contamination of the piled material or may place material on the ground, provided that the bottom of the pile is not incorporated into the Works and in any case, materials supporting stockpiles shall not be used in the Works.

The Contractor shall provide and maintain access to stockpile areas, shall stockpile materials in a manner to prevent segregation and upon completion of the Works shall load and haul excess material to a designated disposal location on-Site or spoil adjacent

to the excavation when authorized by the Engineer. The Contractor shall install erosion control barriers around all stockpiled materials.

Equipment and methods of handling material shall be such as to prevent contamination by foreign material, intermixing, segregation and breakage.

## 1.05 JOB CONDITIONS

### A. Existing Conditions

#### (1) Existing Buried Utilities and Structures

Size, depth and location of existing utilities and structures as shown on the Drawings are approximate and are for guidance only. Completeness and accuracy are not guaranteed. Information of this nature was obtained from visual inspections and surveys.

Prior to commencing any excavation work, the Contractor shall notify the Engineer and applicable authorities, and establish location and state of use of buried utilities and structures. The Contractor shall clearly mark such locations to prevent disturbance during the performance of the Works.

The Contractor shall confirm locations of buried utilities and structures by careful test excavations.

The Contractor shall maintain and protect from damage, water, steam, sewer, gas, electric, telephone and other utilities and structures encountered. The Contractor shall obtain direction from the Engineer before moving or otherwise disturbing utilities or structures.

#### (2) Existing Buildings and Surface Features

The Contractor shall conduct, with the Engineer, a preconstruction condition survey as described in Section 01015.

The Contractor shall repair damage resulting from the Works as described in Section 01015.

Where excavation necessitates root or branch cutting, the Contractor shall do so only as approved by the Engineer.

Where guardrail or fencing is required to be removed, the Contractor shall obtain approval from the Engineer prior to removal and shall remove by dismantling carefully and shall store and protect the components until required for reinstallation by the Contractor.

### B. Environmental Requirements

The Contractor shall control surface water and dewater excavations in accordance with Section 01500. The Contractor shall ensure all stormwater on Site is directed to the on-Site ponds.

The Contractor shall protect open excavations against flooding and damage due to surface runoff. The Contractor shall prevent any runoff from entering excavations.

The Contractor shall suspend operations whenever climatic conditions, as determined by the Engineer, are unsatisfactory for placing fill to the requirements of this Section.

After occurrence of heavy rains, the Contractor shall not operate equipment on previously placed material or on approved excavations until the material has dried sufficiently to prevent occurrence of excessive rutting.

Fill shall not be placed on snow, ice, water or other objectionable material or on improperly prepared excavations or previously placed material.

Where excavations or previously placed material have been softened or eroded, the Contractor shall remove soft and yielding material or otherwise objectionable or damaged areas and replace with compacted fill as specified at no additional cost to the Trust.

C. Protection

The Contractor shall maintain and protect from damage all on-Site materials and any utilities or structures encountered. In the event of disturbance of or damage to any utility or structure the Contractor shall immediately notify the Engineer.

The Contractor shall protect existing buildings, surface features, monitoring wells and piezometers, which may be affected while work is in progress.

The Contractor shall protect existing buildings and structures where temporary unbalanced earth pressures are liable to develop on walls or other structures utilizing bracing, shoring or other approved methods to counteract unbalance.

The Contractor shall protect structures and pipelines from any uplift or disturbance during placement and compaction of backfill material.

The Contractor shall employ procedures for extracting sheeting, placing backfill and discontinuing groundwater control such that they ensure the backfill load is applied gradually and disturbance of utilities, structures and their foundations is avoided.

The Contractor shall protect and ensure the stability of excavations and shall protect open excavations against flooding and damage due to surface runoff or water from any source. Surface water shall be prevented from entering any open excavation.

In the event of damage, the Contractor shall replace or repair damaged areas, structures, monitoring wells and piezometers as directed by the Engineer at no cost to the Trust.

D. Sequencing and Scheduling

The Contractor shall utilize approved native materials from the Works for backfill below subgrade elevations before obtaining backfill material from off-Site sources.

Interruptions of utility services to existing buildings or facilities which become necessary either directly or indirectly due to work required under this Contract shall be coordinated through the Engineer.

The Contractor shall relocate the South Drainage Ditch and the East Pond retaining wall, and excavate and stockpile contaminated soils and sediments prior to commencing installation of the pipe and media drain and manholes.

The Contractor shall construct the final Site cover after all pipe and media drain and extraction well manholes have been constructed to final elevation. All extraction wells, monitoring wells and piezometers shall be installed by other contractor prior to construction of the final Site cover by the Contractor. The Contractor shall allow two (2) months for the installation of extraction wells, monitoring wells and piezometers in the work area by other contractor, prior to commencing construction of final Site cover.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

#### **A. Sources of Imported Material**

Materials shall be provided from a source or sources approved by the Engineer.

#### **B. Unsuitable Imported Soil Material**

Imported soil materials shall be free of unsuitable materials as determined by the Engineer. Unsuitable materials include the following:

1. material containing loam, roots or organic matter;
2. frozen material or material containing snow or ice;
3. clays which are classified as inorganic clays of high plasticity in accordance with ASTM D2487;
4. soft and/or organic clays and silts of low strength;
5. frost susceptible silts or clays;
6. swelling clays;
7. rock and lumps of material with dimensions greater than 6 inches for backfill of deep excavation areas, or with dimensions greater than 1 1/2 inches for backfill of the upper 6 inches of any excavation area, measured through any axis before compaction;
8. trees, stumps, or any other wood or lumber;
9. wire, steel, cast iron, cans, drums or any other foreign materials; and
10. materials containing hazardous or toxic constituents at hazardous or toxic concentrations.

## 2.02 MATERIALS

### A. Native Fill

Native fill for backfilling and grading purposes shall be selected material from excavations and trenches or other sources, approved by the Engineer. Approved material shall mean material that is free of the following unsuitable materials as determined by the Engineer:

1. frozen material or material containing snow or ice,
2. rocks and lumps of material with dimensions greater than specified layer thickness before compaction,
3. other deleterious or foreign matter detrimental to the use intended.

### B. Common Fill

Common fill shall be clean, well graded imported sand and/or gravel type of soil material. Imported common fill shall be free of unsuitable material, as specified in Clause 2.01 this Section. The maximum aggregate size shall be 2 inches, measured through any axis.

### C. Aggregate Material

Aggregate material used for base under manholes, pull boxes, and wet well structures shall conform to Ohio DOT size Number 68, Item 703.01 Coarse Aggregate.

### D. Sand

Sand material used for pipe or conduit bedding shall conform to Ohio DOT Item 703.06.

### E. Granular Material

Granular material to be used for access road construction shall conform to Ohio DOT size Number 68, Item 703.01 coarse Aggregate.

### F. Pipe And Media Drain Aggregate Bedding Material

Pipe and media drain aggregate bedding material shall conform to Ohio DOT size Number 5 Item 703.01 coarse aggregate.

### G. Pipe And Media Drain Aggregate Backfill Material

Pipe and media drain aggregate backfill material shall conform to Ohio Dot size Number 89 Item 703.01 coarse aggregate.

### H. Filter Fabric

Filter fabric for access road, pipe and media drain and filter bedding shall be continuous filament polyester nonwoven needlepoint fabric with EOS number between 70 to 100 U.S. sieve, tensile strength of 200 lbs.

The Contractor shall furnish to the Engineer for approval a representative sample of the geotextile at least 3 feet x 3 feet with the manufacturer's chemical and physical analysis.

I. Cement Grout

Cement grout for wet well bedding shall be minimum Grade 2500, size of coarse aggregate 3/4 inch.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall advise the Engineer in advance of excavation operations to enable the Engineer to take original cross-sections.

The Contractor shall remove fencing, guardrail and other surface features or obstructions from surfaces to be excavated within required limits.

The Contractor shall construct temporary works including shoring, bracing and underpinning to depths, heights and locations approved by the Engineer. Prior to commencing installation of the pipe and media drain, the Contractor shall relocate the South drainage ditch as shown on the drawings. Excess material from excavation of the now South drainage ditch shall be stockpiled for later use in backfilling the work area to pregrade elevations.

The Contractor shall install the Wet Well manhole, temporary dewatering pumps and piping to transfer groundwater from the Wet Well manhole to the existing on-Site water treatment facility prior to commencing installation of the pipe and media drain.

The Contractor shall obtain the necessary permits from the authority having jurisdiction for temporary diversion of water courses.

3.02 INSPECTION

The Contractor shall not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, tests or approvals by the Engineer.

The Contractor shall obtain approval from the Engineer for material to be placed in the Works and for excavations and previously placed material.

The Contractor shall obtain approval from the Engineer prior to placing fill against structures or around exposed buried utilities.

### 3.03 PERFORMANCE

#### A. Excavation and Trenching

##### (1) General

The Contractor shall excavate to lines, grades, elevations and dimensions shown on the Drawings or as directed by the Engineer.

The Contractor shall remove other obstructions encountered during excavation.

During excavation the Contractor shall not interfere with normal 45° splay of bearing from bottom of any concrete structure.

The Contractor shall not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, the Contractor shall excavate by hand and cut roots with sharp axe or saw. The Contractor shall seal cuts with approved tree wound dressing.

The rules of OSHA and the State Department of Labor with respect to excavation and construction shall at all times be strictly observed.

Excavation tolerances shall be within two (2) inches greater or less than the specified depth, but shall not be uniformly greater or less. Maximum pay limits for excavation and backfilling shall be to grades and levels shown on the Drawing.

##### (2) Trenching

Unless otherwise specified or indicated, the Contractor may use any method of excavation which will not damage or endanger adjacent structures or property or disturb the natural or fill soils below and adjacent to the excavation. In no case during performance of the Works shall excavation advance more than 100 feet ahead of the active installation in the trench.

The Contractor shall hand trim, make firm and remove loose material and debris from trenches. Where material at bottom of excavation is disturbed, the Contractor shall compact foundation soil to density at least equal to undisturbed soil.

The Contractor shall use the trench box method or alternative method proposed by the Contractor and approved by the Engineer for excavation and installation of the pipe and media drain. Installation of the pipe and media drain shall commence at the Wet Well and proceed upstream. Groundwater collected in the Wet Well manhole shall be pumped by the Contractor to the on-Site water treatment facility for treatment by the Trust prior to discharge.

The Contractor shall not obstruct flow of surface drainage or natural watercourses.

The Contractor shall excavate to leave earth bottoms of excavations undisturbed, level, free from loose, soft or organic matter.

The Contractor shall notify the Engineer when soil at bottom of the excavation appears unsuitable and shall proceed as directed by the Engineer.



The Contractor shall remove unsuitable material from trench bottom to extent and depth directed by the Engineer.

Except as permitted by the Engineer, the trench at the end of the day shall not be excavated in advance of pipe laying and shall be fully backfilled, except where the trench is fully shielded. The Contractor shall, at the end of the day, secure any shielded area of trench which is left open by surrounding it with snow fencing as a minimum.

Trenches shall be of the necessary width for proper laying of pipe. The banks of pipe trenches shall be as nearly vertical as practicable. Care shall be taken not to over excavate. The bottom of trenches shall be accurately excavated and graded to provide uniform bearing and support for each section of the pipe on full thickness of approved bedding material at every point along its entire length. Stones shall be removed as necessary to avoid point bearing. Except as hereinafter specified for wet or otherwise unstable material, overexcavated depths shall be backfilled as directed by the Engineer with materials specified for backfilling the lower portion of trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such material shall be over extracted to a depth to allow for construction of a stable pipe bedding as directed by the Engineer.

(3) Over Excavation

Where, in the opinion of the Engineer, the undisturbed condition of the soils is inadequate for the support of the forcemain system, the Contractor shall over excavate to adequate supporting soils as directed by the Engineer and shall refill the excavated space with approved material to the proper elevation in accordance with the procedure specified for backfill. Where so directed by the Engineer and except as otherwise specified, the excavation and removal of inadequate material as specified, supply and installation of such material in excess of the quantities shown on the Drawings will be paid for under the appropriate item of the Schedule of Additional Unit Prices. All such over extracted material may be used in the Works or shall be stockpiled on the Site as approved by the Engineer and shall be placed and compacted as specified.

Should unauthorized excavation be carried below the lines and grades indicated on the Drawings because of the Contractor's operations including errors, methods of construction or to suit his convenience, the Contractor shall refill such excavated space to the proper elevation as directed and at the Contractor's sole expense. Should the natural or fill foundation soils be disturbed or loosened because of the Contractor's operations, they shall be recompacted or removed and the space refilled as directed by the Engineer at no additional cost to the Trust.

Where required, due to unauthorized over-excavation, the Contractor shall correct at no additional cost to the Trust as follows:

1. fill under concrete structures with concrete as directed by the Engineer.
2. fill under other areas with specified granular bedding compacted to at least 95% maximum dry density as determined in accordance with ASTM D698.

(4) Excavated Material

Excavated material approved by the Engineer for use as backfill in trenches shall be selected, loaded, hauled to required location and, if necessary, temporarily stockpiled until required in locations approved by the Engineer.

Excavated material not approved by the Engineer for use as backfill in trenches including boulders, debris, brush, roots or other perishable matter shall be used as a fill material for Site grading as approved by the Engineer.

The Contractor shall dispose of waste material and surplus and unsuitable excavated material to designated stockpile areas on-Site as directed by the Engineer, and shall compact stockpiled material in layers not exceeding 12 inches to 90 percent of maximum dry density as determined in accordance with ASTM D698.

(5) Contaminated Soils

The Contractor shall excavate the top two feet of soils from the areas of contaminated soils requiring treatment as shown on the Drawings. These soils are contaminated soils to be treated on Site by other contractor. The Contractor shall load the contaminated soils into approved haulage units and transport the contaminated soil to and neatly stockpile the contaminated soils at the on-Site contaminated soil staging area. All soils stockpiled at the contaminated soil staging area shall be covered with 6-mil reinforced polyethylene sheeting at the end of each day, and if air monitoring indicates the need to cover the stockpiled soils as determined by the approved Contractors Site-specific Health and Safety Plan.

(6) Relocation of South Drainage Ditch

The Contractor shall excavate to relocate the south drainage ditch as shown on the Drawings. Material excavated from the new south drainage ditch shall be used to backfill the entrance to the old south drainage ditch on completion of the new south drainage ditch excavation. Material used to backfill the entrance to the old south drainage ditch shall be compacted to 95% of maximum dry density in layers not exceeding 12 inches. Material excavated from the new south drainage ditch shall be used as native fill materials for backfilling the work area to the bottom of the final Site cover, or stockpiled on Site as specified herein.

(7) Construction of East Drainage Ditch

The Contractor shall construct the east drainage ditch to the lines and elevations shown on the Drawings. Excess material excavated from the east drainage ditch shall be used as fill material for backfilling the work area to the bottom of the final Site cover or stockpiled on Site as specified herein.

(8) Site Grading to Subgrade of Final Site Cover

On completion of the pipe and media drain and manhole installations, the Contractor shall grade the Site to the bottom of the final Site cover using stockpiled and in situ native materials. All backfill shall be compacted to 90% of maximum dry density in accordance with ASTM D698, in layers not exceeding 12 inches in thickness.

(9) Permanent Access Road

The Contractor shall construct a permanent access road to the dimensions, lines and elevations shown on the Drawings, using imported granular material.

B. Temporary Stockpiles

Locations of temporary stockpiles shall be approved by the Engineer prior to placing material in such stockpiles.

Temporary stockpile slopes shall be maintained not steeper than 1.5 horizontal to 1 vertical. In no instance shall stockpiles be greater than ten (10) feet in height above original surrounding grade. Hay bales or soil erosion and sediment control fencing shall be placed at the base of and around each temporary stockpile to contain soil that may be washed off the stockpile.

Stockpiles shall not block natural drainage of surrounding area and area surrounding stockpiles shall be maintained in neat and tidy condition.

The Contractor shall construct and maintain temporary stockpile areas in a properly drained and graded condition so that natural drainage of surrounding area will not be restricted and the area will be free of depressions that will pond or collect water. All surface water shall be diverted around and away from stockpile areas.

Stockpiled material shall be covered with approved reinforced polyethylene sheeting of minimum 6-mil thickness to withstand adverse weather, wind and other detrimental forces. Covering shall provide total protection of stockpiled material from rain and other adverse weather effects. Prior to placing material in approved stockpile areas, the Contractor shall lay down minimum 15-mil polyethylene sheeting to provide separation between supporting surfaces and stockpiled material.

C. Backfilling and Grading

(1) General

The Contractor shall not proceed with backfilling operations until the Engineer has inspected and approved the installations. Areas to be backfilled shall be free from debris, snow, ice, water or frozen ground. The Contractor shall not use backfill material which is frozen or contains ice, snow or debris.

The Contractor shall backfill around installations as follows:

1. cover material for forcemains shall be placed as specified in this Section,
2. except as provided for elsewhere, backfill around or over cast-in-place concrete shall not be placed within 72 hours of concrete placing,
3. layers shall be placed simultaneously, on both sides of installed work to equalize loading,
4. where temporary unbalanced earth pressures are liable to develop on walls or other structures:

- a. permit concrete to cure for maximum seven (7) days or until it has sufficient strength to withstand earth and compaction pressure; obtain approval from the Engineer to backfill,
  - b. if approved by the Engineer, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by the Engineer.
5. material shall be placed by hand under, around and over installations until two feet of cover is provided; backfill shall not be dumped directly on installations.

The Contractor shall place backfill material continuously and in uniform layers not exceeding twelve inches compacted thickness unless specified otherwise, up to grades shown on the Drawings. The Contractor shall compact each layer before placing succeeding layer as specified. The Contractor shall use fill of types specified and shown on the Drawings. During backfill operations, unless otherwise directed by the Engineer, the Contractor shall remove sheeting and shoring from excavations. The Contractor shall not remove bracing until backfilling has reached respective levels of such bracing. Shoring shall be pulled in increments that will ensure compacted backfill is maintained at an elevation at least 20 inches above toe of sheeting.

Where excavated material is insufficient in quantity to complete backfilling, the Contractor shall backfill with an approved clean imported material in accordance with the requirements specified for native fill. The Contractor shall completely use select native fill material approved for backfilling before using imported backfill.

D. Compaction

The Contractor shall compact each layer of backfill placed as specified to achieve the following densities:

1. Under Roadways and Similar Use Pavements Including Adjacent Shoulder Areas. At least 95% of maximum dry density determined in accordance with ASTM D698 up to the elevations at which the requirements for pavement subgrade materials apply; thickness of each layer shall not exceed 6 inches;
2. Under Lawn-Seeded Areas. At least 90% of maximum dry density determined in accordance with ASTM D698 up to the elevations at which the requirements for landscaping apply; thickness of each layer shall not exceed 24 inches;
3. Under Other Areas. At least 90% of maximum dry density determined in accordance with ASTM D698; thickness of each layer shall not exceed 12 inches.

The Contractor shall apply water as is necessary during compaction to obtain specified density. If fill is excessively moist, the Contractor shall aerate with suitable equipment and methods until moisture content is corrected. In areas not accessible to rolling equipment, backfill shall be compacted to specified density with mechanical tampers approved by the Engineer.

The type, size and efficiency of compaction equipment shall be approved by the Engineer and shall be capable of achieving the specified degree of compaction. When operating equipment adjacent to structures, the Contractor shall exercise care so as not to cause damage or displacement.

### 3.04 FIELD QUALITY CONTROL

#### A. Testing by the Engineer

A testing firm hired and approved by the Engineer will perform tests in the field and in the laboratory on samples of compacted fill to determine if materials meet the specified requirements and except as otherwise specified, tests will be at the expense of the Trust. Copies of test reports will be supplied to the Contractor on request. The Contractor shall pay for tests that fail the required specifications.

#### B. Frequency of Testing by Engineer

A minimum of one density test and one moisture content determination will be made for each 2000 yd<sup>3</sup> placed, or more frequent as determined by the Engineer.

A minimum of one particle size analysis may be made for any change in material being used in the backfill.

The method used and the frequency of such tests may be determined by the Engineer. When the Contractor disputes the results of any test, further tests will be taken but the decision to use any test method other than the one chosen will be made only by the Engineer.

#### C. Methods of Testing by Engineer

Relative density of soils containing less than 5% by dry weight of material passing No. 200 sieve will be determined in accordance with ASTM D4253.

Maximum density of soil aggregate containing more than 12% by weight passing No. 200 sieve will be determined in accordance with ASTM D698.

Bulk density will be determined in the field in accordance with ASTM D1556 or with ASTM D2167 or with ASTM D2922, whichever is most suitable to obtain representative density of soil tested.

Particle size analysis will be performed in accordance with ASTM D422 or ASTM D1140, whichever is appropriate to material being tested.

Moisture content of backfill in place will be determined in accordance with ASTM D3017.

#### D. Failure to Meet Specified Requirements

When tests indicate that the required degree of compaction is not achieved or cannot be obtained with the equipment in use or the procedure being followed, the Contractor shall modify his operations so that the equipment and procedures will produce the required results.

The generality of the foregoing does not preclude the Contractor employing other measures to achieve specified results including but not necessarily limited to additional passes of compaction equipment, additional ballast, removing and replacing material, reduction in lift thickness or wetting or drying material.

### 3.05 ADJUSTMENT AND CLEANING

The Contractor shall finish surfaces to established grade but not uniformly high or low. Surface irregularities shall be corrected by loosening and adding or removing material until surface is within specified grade.

The Contractor shall clean and reinstate work areas and areas affected by equipment outside areas specified to be excavated, to specified restoration condition.

Upon completion of backfilling, the Contractor shall remove all excess material and debris from work areas, roads, ditches and shall leave ditches in a properly graded condition sloped as required to permit proper drainage and free of depressions that will pond or collect water or debris that will restrict flow.

All stockpiled material designated to remain at the Site shall be adequately covered and erosion control measures implemented as approved by the Engineer.

## PART 4 - MEASUREMENT AND PAYMENT

### 4.01 EXCAVATION OF CONTAMINATED SOILS AND SEDIMENTS

#### A. Measurement

Measurement for excavation of contaminated soils and sediments will be in cubic yards for the actual number of cubic yards of material excavated as measured in place by the Engineer and calculated using the average end area method from cross-sections, taken prior to excavation and on completion of excavation of contaminated soils and sediments.

#### B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-1 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for excavating contaminated soils and sediments from designated areas of the Work including but not limited to loading and hauling excavated contaminated soils and sediments to designated spoil areas; placing excavated contaminated soils and sediments in designated spoil areas; dewatering of contaminated sediments prior to loading and hauling to designated spoil areas covering stockpiled contaminated soils and sediments with polyethylene sheeting; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.02 RELOCATION OF SOUTH DRAINAGE DITCH

##### A. Measurement

Measurement for relocation of south drainage ditch will be in cubic yards for the actual number of cubic yards of material excavated as measured in place by the Engineer and calculated using the average end area method from cross-sections, taken prior to excavation and on completion of excavation.

##### B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-2 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for relocating the south drainage ditch, including, but not limited to excavating; loading and hauling excavated soils to temporary stockpile areas; placing excavated soils in temporary stockpile areas; backfilling and compacting portion of old south drainage ditch to divert flow to new south drainage ditch; topsoiling, fertilizing and seeding slopes of relocated south drainage ditch and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.03 CONSTRUCTION OF EAST DRAINAGE DITCH

##### A. Measurement

Measurement for construction of east drainage ditch will be made at the actual number of cubic yards of material excavated as measured in place by the Engineer and calculated using the average end area method from cross-sections taken prior to excavation and on completion of excavation.

##### B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-3 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for construction of east drainage ditch; loading and hauling excavated native soils to designated temporary stockpile areas; placing and compacting base and sideslopes of ditch; topsoiling, fertilizing and seeding slopes of east drainage ditch and adjacent areas disturbed during construction of east drainage ditch; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.04 SITE GRADING TO SUBGRADE OF FINAL COVER ELEVATION

##### A. Measurement

Measurement for site grading to subgrade of final cover elevation will be made at the actual number of cubic yards of material installed as measured in place by the Engineer and calculated using the average end area method from cross-sections taken prior to excavation and on completion of grading operation, excluding volume of material used as backfill for installation of forcemains, conduits and pull boxes, pipe and media trench drain, wet well, access manhole and extraction structures.

B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-4 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment required for regrading soils in the work area to subgrade of final soil cover including but not limited to loading, hauling, placing and compacting native soils from temporary stockpiles; placing and compacting excavated native soils; and all other miscellaneous items for which separate payment is not provided under other Items.

4.05 IMPORTED FILL

A. Measurement

Measurement for imported fill will be made at the actual number of cubic yards of imported fill placed as measured in place by the Engineer, calculated using the average end area method from cross-sections taken prior to and following placement of imported fill.

B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item F-5 which price and payment shall be full compensation for supply of all labor, plant, materials and equipment necessary to supply and install imported fill material; temporary stockpiling (if required) and handling material; placing and compacting imported fill; and all other miscellaneous items for which separate payment is not provided under other Items.

4.06 PERMANENT ACCESS ROAD

A. Measurement

Measurement for permanent access road will be made at the actual number of linear feet of access road constructed as measured in place by the Engineer, along the centerline of the road.

B. Payment

Payment for the quantity determined above will be made at the unit price per linear foot stipulated in the Schedule of Prices for Item F-6, which price and payment shall be full compensation for supply of all labor, plant, materials and equipment necessary to supply and install aggregate material, temporary stockpiling (if required) and handling material, placing and compacting of the material; and all other miscellaneous items for which separate payment is not provided under other Items.

Payment for excavation for the pipe and media drain, buried piping, manholes and the wet well will be included under pay items of other Sections.

END OF SECTION



## SECTION 02701 - BURIED PIPING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of underground piping as specified and as shown on the Drawings.

The work includes but is not necessarily limited to the following:

1. supply and installation of 2-inch and 3-inch diameter HDPE forcemain piping;
2. supply and installation of 6-inch diameter HDPE perforated drain pipe;
3. supply and installation of 2-inch diameter PVC electrical and control conduits including warning tape;
4. supply and installation of 36-inch diameter HDPE culvert;
5. excavation and backfilling for installation of buried piping;
6. hydrostatic and leakage testing of buried forcemain piping; and
7. all other activities required to complete the underground piping.

##### B. Related Work Specified in Other Sections

The following items of work related to work of this Section are specified in other sections as noted:

- |                               |               |
|-------------------------------|---------------|
| 1. Excavation and Backfilling | Section 02220 |
| 2. Electrical components      | Section 16050 |

##### C. Terminology

Piping shall mean HDPE pipe, fittings and appurtenances.

Fittings shall include elbows, tees, couplings, flanges, reducers, caps and adaptors.

#### 1.02 QUALITY ASSURANCE

##### A. General

The Contractor shall comply with Section 01300.

**B. Certificates**

The Contractor shall submit manufacturer's certification of all materials to be furnished prior to their delivery to the Site, certifying conformance to this Project Specification.

**C. Installation Instructions**

The Contractor shall submit manufacturer's data sheets and installation instructions including butt fusing methods.

**1.03 PRODUCT DELIVERY AND HANDLING**

**A. Delivery**

The Contractor shall deliver, store and handle pipe in accordance with applicable requirements of the specified references, the manufacturer's instructions and as specified herein.

**B. Storage and Handling**

Pipe shall be stored in the staging area until strung along the alignment.

The Contractor shall use every precaution to prevent damage to the pipe. No metal tools or heavy objects shall be unnecessarily permitted to come in contact with the pipe. Any damage to the pipe from any cause during installation and before final acceptance by the Engineer shall be repaired by the Contractor as directed by the Engineer, at no additional cost to the Trust. Material that, in the opinion of the Engineer, cannot be satisfactorily repaired, shall be removed and replaced at no additional cost to the Trust.

**1.04 JOB CONDITIONS**

**A. Environmental Requirements**

Groundwater encountered during excavations shall be pumped by the Contractor to the on-Site groundwater treatment facility, for treatment by the Trust prior to off-Site discharge. The Contractor shall provide all power, pumps, controls and piping to transfer groundwater from the excavation to the on-Site groundwater treatment facility.

**B. Sequencing and Scheduling**

The Contractor shall schedule work to minimize time during which trenches and excavations remain open. The Contractor shall backfill and grade the work area to pregrade elevations prior to excavation for and installation of buried forcemain and electrical conduit piping. The Contractor shall commence installation of the pipe and media drain after the West Well has been constructed, and shall construct the pipe and media drain commencing at the Wet Well.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Pipe

##### (1) High-Density Polyethylene Pipe (HDPE)

###### (a) General

High density polyethylene pipe (HDPE) shall comply with ASTM D3350, cell classification PE 355434C.

###### (b) HDPE Forcemain

Pipe shall be SDR 11.0 (160 psi) complying with ASTM F714.

Joints shall be butt fused in accordance with the manufacturers instructions. HDPE pipe in 2-inch diameter shall be supplied in coils of maximum length to keep joints to the minimum.

###### (c) HDPE Perforated Drain Pipe

Corrugated pipe and fittings shall conform to AASHTO M252. Corrugated pipe and fittings shall be classified as follows:

Type SP for perforated pipe shall have a full circular cross-section, with an outer corrugated pipe wall and smooth inner surface. Couplings shall be corrugated to match pipe corrugations and shall be of sufficient length and strength to preserve pipe alignment and prevent separation. Couplings shall be neoprene gasketed premium couplers.

###### (d) HDPE Culvert Pipe

HDPE culvert pipe shall be corrugated and shall conform to AASHTO M294 and shall be classified as Type S.

##### (2) HDPE Fittings

HDPE fittings shall be same pressure rating as pipe and shall be butt fusion, molded fittings complying with ASTM D3261.

##### (3) PVC Electrical and Control Conduits

PVC electrical and control conduits shall be heavy wall, schedule 40 type for underground use without concrete encasement.

Warning tape shall comply with Section 16050.

##### (4) Pull Boxes

Pull boxes shall be precast prefabricated concrete structure, 18-inch diameter, complete with precast base, cast iron frame and lid, and shall be Model PB-18S-1 as manufactured by Kistner Concrete Product Inc. or equal.

**B. Bedding Material**

Bedding material for forcemains and PVC conduits shall comply with Section 02220.

Bedding material for perforated drain pipe and backfill material shall comply with Section 02220.

Bedding material for culvert pipe shall comply with Section 02275. Bedding material for pull Boxes shall comply with Section 02220.

**C. Filter Fabric**

Filter Fabric for pipe and media trench drain shall comply with Section 02220.

**PART 3 - EXECUTION**

**3.01 PREPARATION**

The Contractor shall clean pipe of accumulated debris and water before installation.

The Contractor shall carefully inspect materials for defects and shall remove defective materials from the Site.

The Contractor shall supply, erect and maintain approved batter boards and sight rails to ensure accurate line and grade of all pipes. At least 3 batter boards shall be in use at all times, placed not more than 50 feet apart. The Contractor may use other methods of setting line and grade such as laser, providing the method is approved by the Engineer prior to use.

No deviation from the line and grade set out by the Engineer will be tolerated, except where changes in direction of the laying of pipes along a curve are limited to the pipe manufacturer's tolerances for joints.

Piping shall be laid to the lines and grades shown on the Drawings.

**3.02 INSPECTION**

The Contractor shall obtain approval from the Engineer for completed excavation prior to placing bedding material or piping.

**3.03 ERECTION/INSTALLATION/APPLICATION/PERFORMANCE**

**A. Excavation, Trenching and Backfilling**

The Contractor shall excavate, trench and backfill in accordance with Section 02220.

**B. Granular Bedding**

Granular bedding shall be placed to details shown on the Drawings.

The Contractor shall shape bed true to line and grade to provide continuous uniform bearing surface for pipe exterior. Blocks shall not be used when bedding pipe.

The Contractor shall compact the full width of granular bed to at least 95% of maximum dry density as determined in accordance with ASTM D698.

C. High-Density Polyethylene (HDPE) Pipe

HDPE pipe 2-inch diameter shall be field cut in accordance with the manufacturer's instructions to maintain field joints to the minimum.

HDPE pipe except corrugated pipe larger than 2-inch diameter shall be field fused in strict accordance with the manufacturer's instructions. The Contractor shall use a fusing apparatus and personnel trained in the fusing process as approved by the Engineer.

HDPE corrugated pipe shall be joined with corrugated neoprene gasketed premium couplers in strict accordance with the manufacturer's instructions.

Pipe shall not be laid on frozen bedding, water or when trench conditions are unsuitable.

Upon completion of pipe laying and after the Engineer has inspected work in place, the Contractor shall surround and cover pipes between joints with approved cover material placed to dimensions shown on the Drawings.

The Contractor shall hand place cover material and backfill in uniform layers not exceeding twelve (12) inches in thickness to the elevations shown on the Drawings. The Contractor shall not dump material directly on top of pipe.

Layers shall be placed uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

The Contractor shall compact each layer to at least 95% of maximum dry density as determined in accordance with ASTM D698.

3.04 FIELD QUALITY CONTROL

A. General

The Contractor shall provide labor, equipment and materials required to perform hydrostatic and leakage tests herein specified. The Contractor shall notify the Engineer at least 24 hours in advance of all proposed tests. The Contractor shall perform tests in the presence of the Engineer.

The Contractor shall test at one time as much of the piping system as practical and authorized by the Engineer.

Before testing, the Contractor shall bed and cover pipe to prevent movement or snaking of pipe line when test pressure is applied.

Air shall be expelled from piping system by slowly filling system with potable water. The Contractor shall ensure that all air is removed prior to applying tests.

**B. HDPE Hydrostatic Pipe Pressure and Leakage Testing**

The Contractor shall conduct pressure testing by filling piping system with water after joining is complete, and pipe has been laid in trench with no backfill.

The test procedure consists of two steps: the initial expansion phase and the test period.

In order to accommodate the initial expansion of the pipe under test, sufficient make-up water is added to the system at hourly intervals for three hours to bring piping system to the Test Pressure of 100 psi. It is not necessary to calibrate the make-up water for the initial stretching of the pipe.

After the completion of the initial expansion phase (three hours of pressurizing the system to test pressure of 100 psi), the actual test period will begin. The test period must not exceed three hours. After this test period, a measured amount of make-up water should be added to maintain the piping system at the test pressure of 100 psi for a period of three hours. The amount of make-up water added (during the actual test period only), should not exceed allowance for expansion of 0.25 US gallons per 100 feet of 2-inch diameter pipe at the temperature of 73.4°F. When testing the pipe at temperatures below 73.4°F, the amount of make-up water (0.25 US gallons per 100 feet) should be multiplied by the correction factor as follows:

<i>Testing Temperature (°F)</i>	<i>Correction Factor</i>
36	0.25
41	0.30
50	0.42
59	0.55
68	0.75
73.4	1.00

Under no circumstances should the total time under test exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason within this time period, the test section should be permitted to "relax" for an additional eight hour period prior to starting the next testing sequence.

All joints shall be examined for leakage and any joints showing leakage shall be removed from the pipeline, rejoined and the system retested.

It is the responsibility of the Contractor to ensure that normal safety precautions are observed for exposed piping hydrostatic pressure tests.

The Contractor shall locate and repair defects at no additional cost to the Trust if leakage is greater than the amount specified.

The Contractor shall repeat test until leakage is within specified allowance for full length of line.

### 3.05 ADJUSTMENT AND CLEANING

#### A. Forcemain System

On completion, pipes shall be cleaned by flushing. Flushing shall be supplemented by the use of mechanical equipment as necessary to remove foreign material from the pipe.

The Contractor shall not commence flushing operations until hydrostatic and leakage test is completed satisfactorily.

The Contractor shall notify the Engineer at least 24 hours prior to commencing flushing.

The Contractor shall flush forcemain piping through outlets provided by the Contractor with sufficient flow until foreign materials have been removed and flushed water is clear.

Valves and service connections shall be opened and closed to ensure thorough flushing.

The Contractor shall provide connections and pumps as required for flushing operations.

## PART 4 - MEASUREMENT AND PAYMENT

### 4.01 2-INCH HDPE BURIED FORCEMAIN PIPING

#### A. Measurement

Measurement for 2-inch HDPE buried forcemain piping will be in lineal feet for the actual number of lineal feet of 2-inch diameter HDPE piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings.

#### B Payment

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-1 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trenches; dewatering; supply, place and compact granular bedding material where required; supply and install 2"Ø HDPE pipe and fittings; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; backfill and compact trenches; stockpile excess material; performing pressure and leakage tests; final cleaning, flushing and dewatering after completion of all tests; restoration and all other miscellaneous items for which separate payment is not provided under other Items.

### 4.02 3-INCH HDPE BURIED FORCEMAIN PIPING

#### A. Measurement

Measurement for 3-inch HDPE buried forcemain piping will be in lineal feet for the actual number of 3-inch diameter HDPE piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings.

**B. Payment**

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-2 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trenches; dewatering; supply, place and compact granular bedding material where required; supply and install 3"Ø HDPE pipe and fittings; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; backfill and compact trenches; stockpile excess material; performing pressure and leakage tests; final cleaning, flushing and dewatering after completion of all tests; restoration and all other miscellaneous items for which separate payment is not provided under other Items.

**4.03 6-INCH HDPE PERFORATED PIPE AND MEDIA DRAIN**

**A. Measurement**

Measurement for 6-inch HDPE perforated pipe and media drain will be in lineal feet for the actual number of lineal feet of 6-inch diameter HDPE perforated piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings between manholes.

**B. Payment**

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-3 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trench; dewatering; supply and install filter fabric material around media drain material; supply, place and compact granular bedding material where required; supply and install 6-inch diameter HDPE perforated pipe; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; supply, place and compact granular media drain material; shoring and bracing excavations; backfill and compact trenches; stockpile excess material; final cleaning and flushing after completion of installation; restoration; and all other miscellaneous items for which separate payment is not provided under other Items.

**4.04 2-INCH PVC ELECTRICAL AND CONTROL CONDUITS**

**A. Measurement**

Measurement for 2-inch PVC electrical and control conduits will be in lineal feet for the actual number of lineal feet of 2-inch diameter PVC piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings.

**B. Payment**

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-4 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trenches; dewatering; supply, place and compact granular bedding material; supply and install 2-inch PVC conduits and pull boxes; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; backfill and compact



trenches; stockpile excess material; pulling of electrical cables including testing; and all other miscellaneous items for which separate payment is not provided under other Items.

4.05 36-INCH HDPE CULVERT

A. Measurement

Measurement for 36-inch HDPE culvert will be made at the actual number of lineal feet of 36-inch diameter HDPE culvert installed, as measured in place by the Engineer horizontally along the centerline of the culvert continuous through fittings.

B. Payment

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-5 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate; supply, place and compact granular bedding material where required; supply and install 36-inch diameter HDPE pipe and fittings; maintaining line and grade; backfill and compact; stockpile excess material; supply and install rip rap erosion protection; final cleaning; restoration; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 02264 - LOAM FILL

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of loam fill as specified and as shown on the Drawings.

#### 1.02 QUALITY ASSURANCE

The Contractor shall construct the loam fill layer to the lines and grades shown on the Drawings. A tolerance of plus or minus 0.1 foot shall be allowed on the finished elevations of the loam layer.

If in the opinion of the Engineer, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, the Contractor shall obtain an alternate source or demonstrate that material from the source in question can be processed to meet specified requirements.

Should a change of material source be proposed during the Works, the Contractor shall advise the Engineer sufficiently in advance of a proposed change to allow sampling and testing to be completed by the Engineer.

Acceptance of a material at source or failing conduct of sampling and testing at source by the Engineer does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

The Contractor shall bear the cost of sampling and testing of materials which fail to meet specified requirements.

The Contractor shall provide the Engineer access to the source and processed material for the purposes of sampling and testing at least 14 days prior to delivery to the Site.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Source of Materials

The Contractor shall submit to the Engineer the name and location of the proposed source of loam fill to be incorporated into the Works at least 14 days prior to commencing production, including any change in material source during performance of the Works.

C. Geotechnical Data

The Contractor shall submit to the Engineer grain size distribution curves for loam at least 14 days prior to commencing production from any source.

1.04 PRODUCT DELIVERY AND HANDLING

A. Delivery

The Contractor shall handle and transport materials at all times in a manner and with equipment that will avoid segregation and contamination by any deleterious material.

B. Storage and Handling

When necessary, as approved by the Engineer, the Contractor shall stockpile material on the Site in approved locations designated by the Engineer.

The Contractor shall ensure provision of stockpile sites that are level, well drained, free of foreign materials and of adequate bearing capacity to support the weight of the materials to be placed thereon. Stockpiles shall be either far enough apart or separated by substantial dividers to prevent intermingling.

The Contractor shall provide and maintain access to stockpile areas.

Stockpiled material shall be covered with approved polyethylene sheeting of minimum 6 mil thickness to withstand adverse weather, wind and other detrimental forces. Covering shall provide total protection of stockpiled material from rain and other adverse weather effects.

Temporary stockpile slopes shall be maintained not steeper than 1.5 horizontal to 1 vertical.

Stockpiles shall not block natural drainage of surrounding area, and area surrounding stockpiles shall be maintained in neat and tidy condition.

The Contractor shall construct and maintain temporary stockpile areas in a properly drained and graded condition so that natural drainage of surrounding area will not be restricted and the area will be free of depressions that will pond or collect water. All surface water shall be diverted around and away from stockpile areas.

1.05 IOB CONDITIONS

A. Existing Conditions

During all Site activities, the Contractor shall maintain all the existing structures designated to remain in service. Any structure damaged due to the Contractor's operations shall be repaired immediately by the Contractor as specified by the Engineer at no additional cost to the Trust.

B. Environmental Requirements

(1) General

The Contractor shall suspend operations whenever climatic conditions, as determined by the Engineer, are unsatisfactory for placing material to the requirements of this Section.

After occurrence of heavy rains, equipment shall not be operated on previously placed material or on approved excavations until the material has dried sufficiently to prevent rutting.

Loam shall not be placed in a frozen state or against frozen excavations or previously placed frozen material. Loam shall not be placed on snow, ice, water or other objectionable material or on improperly prepared excavations or previously improperly placed material.

Where excavations or previously placed material have been softened or eroded, the Contractor shall remove soft and yielding material or otherwise objectionable or damaged areas and replace with compacted fill as specified.

(2) Dust Control

During all work activities related to construction of loam layer, the Contractor shall keep the Site, adjacent areas and haul routes free from dust and airborne particulate matter as specified in Section 01500.

(3) Dewatering

The Contractor shall keep the Works free of water in accordance with Section 01500.

C. Protection

When placing and compacting loam, the Contractor shall not disturb satisfactorily placed material or structures already in place.

Surfaces of loam shall be crowned or sloped with grades shown on the Drawings so that surface will drain freely.

The Contractor shall not route or permit traffic to travel over in-place loam without approval from the Engineer.

The Contractor shall maintain and protect from damage all utilities, structures, monitoring wells, piezometers, manholes, gravel access roads, and security fences remaining in service. In the event of disturbance or damage of any utility or structure the Contractor shall immediately notify the Engineer.

The Contractor shall protect existing buildings and surface features which may be affected while work is in progress.

The Contractor shall protect existing buildings and structures where temporary unbalanced earth pressures are liable to develop on walls or other structures utilizing bracing, shoring or other approved methods to counteract unbalance.

Placement, haulage or any other construction equipment that may cause damage to loam or other layer, shall at no time operate upon such layers.

Immediately prior to temporary suspension of fill operations, the Contractor shall roll or grade filled surfaces under construction to grades specified so as to leave the surface free of ruts, depressions or areas that will pond or collect water.

D. Sequencing and Scheduling

The Contractor shall sequence delivery of materials to the Site in a manner to minimize stockpiling and in any event the Contractor shall obtain approval from the Engineer to stockpile.

PART 2 - PRODUCTS

2.01 LOAM FILL

Fill to be used for the loam final cover shall be clean, well graded imported sandy loam soil material free of unsuitable material as specified below. The maximum aggregate size shall be 2 inches measured through any axis and D<sub>10</sub> (particle size which 10 percent of particles by mass are smaller than) shall be less than 0.01 mm. The permeability of the sandy loam shall not exceed  $1 \times 10^{-4}$  cm/s.

Unsuitable materials shall mean materials which are not approved for use as determined by the Engineer and shall include the following:

1. frozen material or material containing snow or ice;
2. clays which are classified as inorganic clays of high plasticity in accordance with ASTM D2487;
3. soft and/or organic clays and silts of low strength;
4. frost susceptible silts or clays;
5. swelling clays;
6. trees, stumps, branches, or any other wood or lumber;
7. wire, steel, cast iron, cans, drums or any other foreign materials; and
8. materials containing hazardous or toxic constituents at hazardous or toxic concentrations.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall advise the Engineer in advance of placement of loam fill operations to enable the Engineer to take original cross-sections.

The Contractor shall ensure that areas to receive loam fill are free from debris, snow, ice, water or frozen ground.

### 3.02 INSPECTION

The Contractor shall obtain approval from the Engineer for material to be placed in the Works and for surfaces or previously placed material prior to placing loam fill.

### 3.03 INSTALLATION

#### A. Placing

The Contractor shall place loam fill continuously and in uniform layers not exceeding twelve (12) inches compacted thickness unless specified otherwise, up to grades shown on the Drawings. The Contractor shall compact each layer before placing succeeding layer as specified. Loam fill shall be placed without segregating material.

#### B Compaction

The Contractor shall compact each layer of fill as specified to achieve the following densities:

##### 1. Under Roadways and Similar Use Pavements Including Adjacent Shoulder Areas

At least 95% of maximum dry density determined in accordance with ASTM D698 up to the elevations at which the requirements for pavement subgrade materials apply; thickness of each layer shall not exceed 6 inches; and

##### 2. Under Lawn-Seeded Areas

At least 90% of maximum dry density determined in accordance with ASTM D698 up to the elevations at which the requirements for landscaping apply; thickness of each layer shall not exceed 12 inches.

The Contractor shall apply water as is necessary during compaction to obtain specified density. If fill is excessively moist, the Contractor shall aerate with suitable equipment and methods until moisture content is corrected. In areas not accessible to rolling equipment, loam fill shall be compacted to specified density with mechanical tampers approved by the Engineer.

The type, size and efficiency of compaction equipment shall be approved by the Engineer and shall be capable of achieving the specified degree of compaction. When operating equipment adjacent to structures, the Contractor shall exercise care so as not to cause damage or displacement to the adjacent structure.

Whenever use of rollers is not practical, the Contractor shall compact the loam fill using hand-operated power tampers or other compaction equipment approved by the Engineer to achieve the specified degree of compaction for rollers.

### 3.04 FIELD QUALITY CONTROL

#### A. Quality Control by Engineer

The Engineer will select samples of uncompacted fill intended for the Works and samples of compacted fill in the Works. The Engineer will perform tests in the field and in the laboratory on samples of uncompacted and compacted fill to determine if materials meet the specification and except as otherwise specified, tests will be at the expense of the Trust. Copies of test reports will be supplied to the Contractor on request.

#### B. Frequency of Testing by Engineer

A minimum of one density test and one moisture content determination will be made for each 2,000 yd<sup>3</sup> placed, or more frequent as determined by the Engineer.

A minimum of one particle size analysis will be made for any change in material being used in the fill.

The method used and the frequency of such tests may be determined by the Engineer. When the Contractor disputes the results of any test, further tests will be taken but the decision to use any test method other than the one chosen will be made only by the Engineer.

#### C. Methods of Testing by Engineer

Maximum density of loam fill will be determined in accordance with ASTM D698.

Bulk density will be determined in the field in accordance with ASTM D1556 or with ASTM D2167 or with ASTM D2922, whichever is most suitable to obtain representative density of soil tested.

Particle size analysis will be performed in accordance with ASTM D422 or ASTM D1140, whichever is appropriate to material being tested.

Moisture content of loam fill in place will be determined in accordance with ASTM D3017.

#### D. Failure to Meet Specified Requirements

When tests indicate that the required degree of compaction is not achieved or cannot be obtained with the equipment in use or the procedure being followed, the Contractor shall modify his operations so that the equipment and procedures will produce the required results.

The generality of the foregoing does not preclude the Contractor employing other measures to achieve specified results including but not necessarily limited to additional passes of compaction equipment, additional ballast, removing and replacing material, reduction in lift thickness or wetting or drying material.

3.05 ADJUSTMENT AND CLEANING

The Contractor shall finish surfaces to established grade but not uniformly high or low. Surface irregularities shall be corrected by loosening and adding or removing material until surface is within specified grade.

The Contractor shall clean and reinstate work areas and areas affected by equipment outside areas specified to be excavated, to specified restoration condition.

Upon completion of filling, the Contractor shall remove all excess material and debris from work areas, roads, ditches and shall leave ditches in a properly graded condition sloped as required to permit proper drainage and free of depressions that will pond or collect water or debris that will restrict flow.

All stockpiled material designated to remain at the Site shall be adequately covered and erosion control measures implemented as approved by the Engineer.

PART 4 - MEASUREMENT AND PAYMENT

4.01 LOAM FILL

A. Measurement

Measurement for loam fill will be made at the actual number of cubic yards of loam soil final cover installed as measured in place by the Engineer, calculated using the average end area method from cross-sections taken prior to and following completion of loam fill operations.

B. Payment

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item G-1 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to construct loam fill; supply and installation of loam soil layer; provision and maintenance of soil erosion and sediment control facilities; dust control; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION



## SECTION 02275 - RIP RAP LINING SYSTEM

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of rip rap lining system as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. Supply and installation of the East Ditch rip rap lining system consisting of an 8-inch rip rap layer underlain by a 6-inch coarse aggregate bedding layer and geotextile.

##### B. Technical Requirements specified in other Sections

The following items of work shall be carried out in accordance with the technical requirements of the sections noted below:

- |                             |               |
|-----------------------------|---------------|
| 1. Placement of common fill | Section 02220 |
| 2. Vegetative Cover         | Section 02900 |

#### 1.02 QUALITY ASSURANCE

##### A. General

Should a change of material source be proposed during the Work, the Contractor shall advise the Engineer sufficiently in advance of a proposed change to allow sampling and testing to be completed by the Engineer.

Acceptance of a material at source or failing conduct of sampling and testing at source by the Engineer does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

The Contractor shall bear the cost of sampling and testing of materials which fail to meet specified requirements.

##### B. Tolerances

The Contractor shall construct the subcomponents of the rip rap lining systems to the dimensions, lines, and elevations as detailed on the Drawings.

A tolerance of plus or minus 0.1 foot shall be allowed on the finished elevations of the rip rap lining systems.

### 1.03 SUBMITTALS

#### A. General

The Contractor shall comply with Section 01300.

#### B. Source

The Contractor shall submit to the Engineer the proposed source of materials to be incorporated into the Work and test results confirming suitability of the material for the purpose intended at least 14 days prior to commencing construction of the rip rap lining system including any change in material source during performance of the Work.

If in the opinion of the Engineer, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, the Contractor shall obtain an alternate source or demonstrate that material from the source in question can be processed to meet specified requirements.

#### C. Geotechnical Data

The Contractor shall submit to the Engineer grain size distribution curves for each classification of material at least 14 days prior to commencing construction of the rip rap lining system.

#### D. Product Data

Manufacturer's product data for geotextile including installation, handling, storage and repair instructions shall be submitted to the Engineer 14 days prior to installation.

### 1.04 PRODUCT DELIVERY AND HANDLING

#### A. Delivery

The Contractor shall handle and transport materials at all times in a manner and with equipment that will avoid segregation and contamination by any deleterious material.

Geotextile shall be delivered bearing manufacturer's seals and labels intact. Each roll shall be clearly labeled to show geotextile identification, date of manufacture, lot number, analysis of contents and special instructions.

#### B. Storage and Handling

When necessary, as approved by the Engineer, the Contractor shall stockpile material on the Site in approved locations designated by the Engineer.

The Contractor shall ensure and provide that stockpile sites are level, well drained, free of foreign materials, and of adequate bearing capacity to support the weight of the materials to be placed thereon. Stockpiles shall be either far enough apart or separated by substantial dividers to prevent intermingling.

Except where material is stockpiled on acceptably stabilized areas, the Contractor shall provide a suitable base to prevent contamination of the piled material or may place

material on the ground, provided that the bottom of the pile is not incorporated into the Work and in any case, materials supporting stockpiles shall not be used in the Work.

The Contractor shall provide and maintain access to stockpile areas, shall stockpile materials in a manner to prevent segregation and upon completion of the Work shall leave stockpile sites in a tidy, well drained condition, free of standing surface water and stockpiled material.

Equipment and methods of handling material shall be such as to prevent contamination by foreign material, intermixing, segregation and breakage.

Geotextile shall be stored and handled in accordance with manufacturer's recommendations. Geotextile shall be stored indoors, in the manufacturer's original covers and shall be protected from moisture, dust, light and heat.

Upon arrival at the Site, the Contractor and the Engineer shall inspect all materials for defects in the manufacturing process and for damage during transportation including rips, holes, flaws, deterioration or other damage. Materials judged by the Engineer to be severely damaged shall be rejected and removed from the Site. Minor damages and other defects as determined solely by the Engineer shall be repaired to the Engineer's approval.

#### 1.05 JOB CONDITIONS

##### A. Existing Conditions

During all Site activities, the Contractor shall maintain all the existing structures designated to remain in service, including monitoring wells and piezometers. Any structure damaged due to the Contractor's operations shall be repaired immediately by the Contractor as specified by the Engineer at no cost to the Trust.

##### B. Environmental Requirements

###### (1) General

The Contractor shall suspend operations whenever climatic conditions, as determined by the Engineer, are unsatisfactory for placing material to the requirements of this Section.

After occurrence of heavy rains, equipment shall not be operated on previously placed material or on approved excavations until the material has dried sufficiently to prevent rutting.

Fill shall not be placed in a frozen state or against frozen excavations or previously placed frozen material. Fill shall not be placed on snow, ice, water or other objectionable material or on improperly prepared excavations or previously placed material.

Where excavations or previously placed material have been softened or eroded, the Contractor shall remove soft and yielding material or otherwise objectionable or damaged areas and replace with compacted fill as specified.

Geotextile shall be installed in dry conditions and in accordance with manufacturer's instructions. Unless specially selected for their ultraviolet light resistance, geotextile shall not be exposed to sunlight more than 24 hours or as recommended by the manufacturer.

(2) Dust Control

During all work activities related to construction of the rip rap lining system, the Contractor shall keep the Site, adjacent areas and haul routes free from dust and airborne particulate matter as specified in Section 01500.

(3) Dewatering

The Contractor shall keep the Work free of water in accordance with Section 01500.

C. Protection

When placing and compacting fill, the Contractor shall not disturb satisfactorily placed material or structures already in place.

Surfaces of fill shall be crowned or sloped with grades shown on the Drawings so that surface will drain freely.

The Contractor shall not route or permit traffic to travel over in-place fill without approval from the Engineer.

The Contractor shall maintain and protect from damage all utilities and structures remaining in service. In the event of disturbance or damage of any utility or structure the Contractor shall immediately notify the Engineer.

The Contractor shall protect existing buildings and surface features which may be affected while work is in progress.

The Contractor shall protect existing buildings and structures where temporary unbalanced earth pressures are liable to develop on walls or other structures utilizing bracing, shoring or other approved methods to counteract unbalance.

Placement, haulage or any other construction equipment that may cause damage to liners, sand blankets, filter fabrics or soil layers, as determined by the Engineer, shall at no time operate upon such layers.

Immediately prior to temporary suspension of fill operations, the Contractor shall roll or grade filled surfaces under construction to grades specified so as to leave the surface free of ruts, depressions or areas that will pond or collect water.

Geotextile shall be protected from damage including punctures, tears, contamination and stains.

The Contractor shall not permit or cause rip rap to slide or roll down slopes.

D. Sequencing and Scheduling

The Contractor shall sequence delivery of materials to the Site in a manner to minimize stockpiling and in any event the Contractor shall obtain approval from the Engineer to stockpile.

Geotextile installation shall not commence before surfaces are properly prepared.

**PART 2 - PRODUCTS**

2.01 GENERAL

A. Source of imported Materials

Materials shall be provided from a source or sources approved by the Engineer.

B. Unsuitable Imported Soil Material

Imported soil materials shall be free of unsuitable materials as determined by the Engineer. Unsuitable materials include the following:

1. material containing loam, roots or organic matter;
2. frozen material or material containing snow or ice;
3. clays which are classified as inorganic clays of high plasticity in accordance with ASTM D2487;
4. soft and/or organic clays and silts of low strength;
5. frost susceptible silts or clays;
6. swelling clays;
7. rock and lumps of material with dimensions greater than 6 inches for backfill of deep excavation areas or 1 1/2 inches for backfill of the upper 6 inches of any excavation area, measured through any axis before compaction;
8. trees, stumps, branches, or any other wood or lumber; and
9. wire, steel, cast iron, cans, drums or any other foreign materials.

2.02 MATERIALS

A. Rip Rap

Rip rap shall be unweathered, durable igneous, metamorphic or sedimentary rock and shall be free from organic, mica, shale or other unsuitable material.

Individual rock fragments shall be hard, dense, sound and resistant to abrasion and shall be free of cracks, seams and other structural defects that would tend to increase unduly

their destruction by water and frost action and handling. Rock exhibiting marked deterioration by water or weather shall not be used.

Rock size for rip rap shall be as follows:

<i>Size</i>	<i>Percentage of Total Weight Smaller Than Given Size</i>
8"	100%
6"	85%
4"	50%
2"	15%

**B    Coarse Aggregate Bedding Layer**

Coarse aggregate bedding layer shall conform to Ohio DOT 703-1 size number 6, Item 703.01 Coarse Aggregate.

**C.    Geotextile**

Geotextile filter fabric material shall be as specified in Section 02220.

**PART 3 - EXECUTION**

**3.01    PREPARATION**

Prior to placement of rip rap lining system the entire area to be covered shall be graded, shaped, excavated and/or filled as required to the specified subgrade lines, grades and dimensions. All construction activities below rip rap lining areas including but not limited to demolition, ditch excavation, drainage structures, pipe and media drain and manhole installation, sediment removal shall be completed prior to commencing with installation of the rip rap lining system.

Unless otherwise specified or shown on the Drawings, the entire area to be lined shall be compacted to 90% of maximum dry density as determined in accordance with ASTM D698. Settlement or subsidence caused by compaction shall be filled to specified levels with specified fill material and compacted as specified above.

Under no circumstances shall any material be placed until such time as the area has been compacted to the approval of the Engineer and all other measurements, tests and inspections have been completed.

**3.02    INSPECTION**

The Contractor shall obtain approval from the Engineer to commence placement of the rip rap lining system.

**3.03    INSTALLATION**

The Contractor shall not place rip rap or bedding material until the Engineer has inspected and approved the foundation to receive ditch lining system.

A 6-inch coarse aggregate bedding layer shall be placed and compacted on the geotextile followed by the 8-inch stone rip rap layer. The coarse aggregate layer shall be placed in accordance with the Drawings and Section 02220.

The Contractor shall place rip rap by suitable methods so that rip rap does not mix with or damage foundations and to ensure minimum breakage of individual pieces during placing.

Rip rap shall be placed in accordance with layer thicknesses and details shown on the Drawings.

Rip rap shall be placed in an approved manner to secure the surface and to provide a stable mass.

Larger rock shall be uniformly distributed over the entire area and the remainder uniformly distributed with smaller pieces filling voids between larger pieces.

The Contractor shall furnish surfaces in such a manner to ensure they are stable, reasonably uniform, free from bumps or depressions with no excessively large cavities below or individual rock pieces projecting above the general surface.

Geotextiles shall be placed in locations shown on the Drawings.

Geotextiles shall be overlapped minimum 1 foot unless otherwise shown on the Drawings. If necessary because of the wind, the overlaps can be glued together with spots of glue one to three per yard.

Geotextile shall be positioned and deployed to minimize handling. Geotextile shall be laid smooth and free of tension, stress, folds, wrinkles or creases. Properly placed geotextile shall be protected from displacement, contaminated by surface runoff, or damage until and during placement of overlaid materials.

Geotextile to be placed on sloping surfaces shall be placed in one continuous length from toe of slope to upper extent of geotextile.

Passage of vehicular traffic shall not be permitted directly on geotextile at any time.

#### 3.04 FIELD QUALITY CONTROL

Soil and aggregate material layers shall be inspected and tested in accordance with Section 02220 for each 6-inch compacted layer placed.

Under no circumstances shall a layer or an element of the rip rap lining system be placed until the underlying surface, layer and/or element has been satisfactorily inspected, tested and approved by the Engineer.

#### 3.05 ADJUSTMENT AND CLEANING

Adjustments to the rip rap lining system to incorporate structures, discharge aprons, erosion protection, etc. shall be approved by the Engineer prior to making the adjustments.

**PART 4 - MEASUREMENT AND PAYMENT**

**4.01 EAST DITCH RIP RAP LINING SYSTEM**

**A. Measurement**

Measurement for east ditch rip rap lining system will be made at the actual number of square yards of rip rap lining system installed as measured in place by the Engineer.

**B. Payment**

Payment for the quantity determined above will be made at the unit price per square yard stipulated in the Schedule of Prices for Item H-1 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to construct the rip rap lining system; supply and installation of 8-inch rip rap stone layer, supply and installation of 6-inch coarse aggregate (DOT Size No. 6) layer, and supply and installation of geotextile; and all other miscellaneous items for which separate payment is not provided under other Items.

**END OF SECTION**



## SECTION 02701 - BURIED PIPING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of underground piping as specified and as shown on the Drawings.

The work includes but is not necessarily limited to the following:

1. supply and installation of 2-inch and 3-inch diameter HDPE forcemain piping;
2. supply and installation of 6-inch diameter HDPE perforated drain pipe;
3. supply and installation of 2-inch diameter PVC electrical and control conduits including warning tape;
4. supply and installation of 36-inch diameter HDPE culvert;
5. excavation and backfilling for installation of buried piping;
6. hydrostatic and leakage testing of buried forcemain piping; and
7. all other activities required to complete the underground piping.

##### B. Related Work Specified in Other Sections

The following items of work related to work of this Section are specified in other sections as noted:

- |                               |               |
|-------------------------------|---------------|
| 1. Excavation and Backfilling | Section 02220 |
| 2. Electrical components      | Section 16050 |

##### C. Terminology

Piping shall mean HDPE pipe, fittings and appurtenances.

Fittings shall include elbows, tees, couplings, flanges, reducers, caps and adaptors.

#### 1.02 QUALITY ASSURANCE

##### A. General

The Contractor shall comply with Section 01300.

B. Certificates

The Contractor shall submit manufacturer's certification of all materials to be furnished prior to their delivery to the Site, certifying conformance to this Project Specification.

C. Installation Instructions

The Contractor shall submit manufacturer's data sheets and installation instructions including butt fusing methods.

1.03 PRODUCT DELIVERY AND HANDLING

A. Delivery

The Contractor shall deliver, store and handle pipe in accordance with applicable requirements of the specified references, the manufacturer's instructions and as specified herein.

B. Storage and Handling

Pipe shall be stored in the staging area until strung along the alignment.

The Contractor shall use every precaution to prevent damage to the pipe. No metal tools or heavy objects shall be unnecessarily permitted to come in contact with the pipe. Any damage to the pipe from any cause during installation and before final acceptance by the Engineer shall be repaired by the Contractor as directed by the Engineer, at no additional cost to the Trust. Material that, in the opinion of the Engineer, cannot be satisfactorily repaired, shall be removed and replaced at no additional cost to the Trust.

1.04 JOB CONDITIONS

A. Environmental Requirements

Groundwater encountered during excavations shall be pumped by the Contractor to the on-Site groundwater treatment facility, for treatment by the Trust prior to off-Site discharge. The Contractor shall provide all power, pumps, controls and piping to transfer groundwater from the excavations to the on-Site groundwater treatment facility.

B. Sequencing and Scheduling

The Contractor shall schedule work to minimize time during which trenches and excavations remain open. The Contractor shall backfill and grade the work area to pregrade elevations prior to excavation for and installation of buried forcemain and electrical conduit piping. The Contractor shall commence installation of the pipe and media drain after the West Well has been constructed, and shall construct the pipe and media drain commencing at the Wet Well.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Pipe

##### (1) High-Density Polyethylene Pipe (HDPE)

###### (a) General

High density polyethylene pipe (HDPE) shall comply with ASTM D3350, cell classification PE 355434C.

###### (b) HDPE Forcemain

Pipe shall be SDR 11.0 (160 psi) complying with ASTM F714.

Joints shall be butt fused in accordance with the manufacturers instructions. HDPE pipe in 2-inch diameter shall be supplied in coils of maximum length to keep joints to the minimum.

###### (c) HDPE Perforated Drain Pipe

Corrugated pipe and fittings shall conform to AASHTO M252. Corrugated pipe and fittings shall be classified as follows:

Type SP for perforated pipe shall have a full circular cross-section, with an outer corrugated pipe wall and smooth inner surface. Couplings shall be corrugated to match pipe corrugations and shall be of sufficient length and strength to preserve pipe alignment and prevent separation. Couplings shall be neoprene gasketed premium couplers.

###### (d) HDPE Culvert Pipe

HDPE culvert pipe shall be corrugated and shall conform to AASHTO M294 and shall be classified as Type S.

##### (2) HDPE Fittings

HDPE fittings shall be same pressure rating as pipe and shall be butt fusion, molded fittings complying with ASTM D3261.

##### (3) PVC Electrical and Control Conduits

PVC electrical and control conduits shall be heavy wall, schedule 40 type for underground use without concrete encasement.

Warning tape shall comply with Section 16050.

##### (4) Pull Boxes

Pull boxes shall be precast prefabricated concrete structure, 18-inch diameter, complete with precast base, cast iron frame and lid, and shall be Model PB-18S-1 as manufactured by Kistner Concrete Product Inc. or equal.

**B. Bedding Material**

Bedding material for forcemains and PVC conduits shall comply with Section 02220.

Bedding material for perforated drain pipe and backfill material shall comply with Section 02220.

Bedding material for culvert pipe shall comply with Section 02275. Bedding material for pull Boxes shall comply with Section 02220.

**C. Filter Fabric**

Filter Fabric for pipe and media trench drain shall comply with Section 02220.

**PART 3 - EXECUTION**

**3.01 PREPARATION**

The Contractor shall clean pipe of accumulated debris and water before installation.

The Contractor shall carefully inspect materials for defects and shall remove defective materials from the Site.

The Contractor shall supply, erect and maintain approved batter boards and sight rails to ensure accurate line and grade of all pipes. At least 3 batter boards shall be in use at all times, placed not more than 50 feet apart. The Contractor may use other methods of setting line and grade such as laser, providing the method is approved by the Engineer prior to use.

No deviation from the line and grade set out by the Engineer will be tolerated, except where changes in direction of the laying of pipes along a curve are limited to the pipe manufacturer's tolerances for joints.

Piping shall be laid to the lines and grades shown on the Drawings.

**3.02 INSPECTION**

The Contractor shall obtain approval from the Engineer for completed excavation prior to placing bedding material or piping.

**3.03 ERECTION/INSTALLATION/APPLICATION/PERFORMANCE**

**A. Excavation, Trenching and Backfilling**

The Contractor shall excavate, trench and backfill in accordance with Section 02220.

**B. Granular Bedding**

Granular bedding shall be placed to details shown on the Drawings.

The Contractor shall shape bed true to line and grade to provide continuous uniform bearing surface for pipe exterior. Blocks shall not be used when bedding pipe.

The Contractor shall compact the full width of granular bed to at least 95% of maximum dry density as determined in accordance with ASTM D698.

C. High-Density Polyethylene (HDPE) Pipe

HDPE pipe 2-inch diameter shall be field cut in accordance with the manufacturer's instructions to maintain field joints to the minimum.

HDPE pipe except corrugated pipe larger than 2-inch diameter shall be field fused in strict accordance with the manufacturer's instructions. The Contractor shall use a fusing apparatus and personnel trained in the fusing process as approved by the Engineer.

HDPE corrugated pipe shall be joined with corrugated neoprene gasketed premium couplers in strict accordance with the manufacturer's instructions.

Pipe shall not be laid on frozen bedding, water or when trench conditions are unsuitable.

Upon completion of pipe laying and after the Engineer has inspected work in place, the Contractor shall surround and cover pipes between joints with approved cover material placed to dimensions shown on the Drawings.

The Contractor shall hand place cover material and backfill in uniform layers not exceeding twelve (12) inches in thickness to the elevations shown on the Drawings. The Contractor shall not dump material directly on top of pipe.

Layers shall be placed uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

The Contractor shall compact each layer to at least 95% of maximum dry density as determined in accordance with ASTM D698.

3.04 FIELD QUALITY CONTROL

A. General

The Contractor shall provide labor, equipment and materials required to perform hydrostatic and leakage tests herein specified. The Contractor shall notify the Engineer at least 24 hours in advance of all proposed tests. The Contractor shall perform tests in the presence of the Engineer.

The Contractor shall test at one time as much of the piping system as practical and authorized by the Engineer.

Before testing, the Contractor shall bed and cover pipe to prevent movement or snaking of pipe line when test pressure is applied.

Air shall be expelled from piping system by slowly filling system with potable water. The Contractor shall ensure that all air is removed prior to applying tests.

**B. HDPE Hydrostatic Pipe Pressure and Leakage Testing**

The Contractor shall conduct pressure testing by filling piping system with water after joining is complete, and pipe has been laid in trench with no backfill.

The test procedure consists of two steps: the initial expansion phase and the test period.

In order to accommodate the initial expansion of the pipe under test, sufficient make-up water is added to the system at hourly intervals for three hours to bring piping system to the Test Pressure of 100 psi. It is not necessary to calibrate the make-up water for the initial stretching of the pipe.

After the completion of the initial expansion phase (three hours of pressurizing the system to test pressure of 100 psi), the actual test period will begin. The test period must not exceed three hours. After this test period, a measured amount of make-up water should be added to maintain the piping system at the test pressure of 100 psi for a period of three hours. The amount of make-up water added (during the actual test period only), should not exceed allowance for expansion of 0.25 US gallons per 100 feet of 2-inch diameter pipe at the temperature of 73.4°F. When testing the pipe at temperatures below 73.4°F, the amount of make-up water (0.25 US gallons per 100 feet) should be multiplied by the correction factor as follows:

<i>Testing Temperature (°F)</i>	<i>Correction Factor</i>
36	0.25
41	0.30
50	0.42
59	0.55
68	0.75
73.4	1.00

Under no circumstances should the total time under test exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason within this time period, the test section should be permitted to "relax" for an additional eight hour period prior to starting the next testing sequence.

All joints shall be examined for leakage and any joints showing leakage shall be removed from the pipeline, rejoined and the system retested.

It is the responsibility of the Contractor to ensure that normal safety precautions are observed for exposed piping hydrostatic pressure tests.

The Contractor shall locate and repair defects at no additional cost to the Trust if leakage is greater than the amount specified.

The Contractor shall repeat test until leakage is within specified allowance for full length of line.

3.05 ADJUSTMENT AND CLEANING

A. Forcemain System

On completion, pipes shall be cleaned by flushing. Flushing shall be supplemented by the use of mechanical equipment as necessary to remove foreign material from the pipe.

The Contractor shall not commence flushing operations until hydrostatic and leakage test is completed satisfactorily.

The Contractor shall notify the Engineer at least 24 hours prior to commencing flushing.

The Contractor shall flush forcemain piping through outlets provided by the Contractor with sufficient flow until foreign materials have been removed and flushed water is clear.

Valves and service connections shall be opened and closed to ensure thorough flushing.

The Contractor shall provide connections and pumps as required for flushing operations.

PART 4 - MEASUREMENT AND PAYMENT

4.01 2-INCH HDPE BURIED FORCEMAIN PIPING

A. Measurement

Measurement for 2-inch HDPE buried forcemain piping will be in lineal feet for the actual number of lineal feet of 2-inch diameter HDPE piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings.

B. Payment

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-1 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trenches; dewatering; supply, place and compact granular bedding material where required; supply and install 2"Ø HDPE pipe and fittings; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; backfill and compact trenches; stockpile excess material; performing pressure and leakage tests; final cleaning, flushing and dewatering after completion of all tests; restoration and all other miscellaneous items for which separate payment is not provided under other Items.

4.02 3-INCH HDPE BURIED FORCEMAIN PIPING

A. Measurement

Measurement for 3-inch HDPE buried forcemain piping will be in lineal feet for the actual number of 3-inch diameter HDPE piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings.

**B. Payment**

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-2 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trenches; dewatering; supply, place and compact granular bedding material where required; supply and install 3"Ø HDPE pipe and fittings; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; backfill and compact trenches; stockpile excess material; performing pressure and leakage tests; final cleaning, flushing and dewatering after completion of all tests; restoration and all other miscellaneous items for which separate payment is not provided under other Items.

**4.03 6-INCH HDPE PERFORATED PIPE AND MEDIA DRAIN**

**A. Measurement**

Measurement for 6-inch HDPE perforated pipe and media drain will be in lineal feet for the actual number of lineal feet of 6-inch diameter HDPE perforated piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings between manholes.

**B. Payment**

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-3 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trench; dewatering; supply and install filter fabric material around media drain material; supply, place and compact granular bedding material where required; supply and install 6-inch diameter HDPE perforated pipe; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; supply, place and compact granular media drain material; shoring and bracing excavations; backfill and compact trenches; stockpile excess material; final cleaning and flushing after completion of installation; restoration; and all other miscellaneous items for which separate payment is not provided under other Items.

**4.04 2-INCH PVC ELECTRICAL AND CONTROL CONDUITS**

**A. Measurement**

Measurement for 2-inch PVC electrical and control conduits will be in lineal feet for the actual number of lineal feet of 2-inch diameter PVC piping installed, as measured in place by the Engineer horizontally along the centerline of the pipe continuous through fittings.

**B. Payment**

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-4 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate the trenches; dewatering; supply, place and compact granular bedding material; supply and install 2-inch PVC conduits and pull boxes; maintaining line and grade; supplying, placing and connection of all pipe fittings and bends; backfill and compact



trenches; stockpile excess material; pulling of electrical cables including testing; and all other miscellaneous items for which separate payment is not provided under other Items.

4.05 36-INCH HDPE CULVERT

A. Measurement

Measurement for 36-inch HDPE culvert will be made at the actual number of lineal feet of 36-inch diameter HDPE culvert installed, as measured in place by the Engineer horizontally along the centerline of the culvert continuous through fittings.

B. Payment

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item I-5 which price and payment shall be full compensation for supplying all labor, plant, materials and equipment required to excavate; supply, place and compact granular bedding material where required; supply and install 36-inch diameter HDPE pipe and fittings; maintaining line and grade; backfill and compact; stockpile excess material; supply and install rip rap erosion protection; final cleaning; restoration; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 02724 - MANHOLES AND CHAMBERS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of manholes and chambers as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. supply and installation of eight access manholes and one wet well manhole for the pipe and media drain collection system;
2. supply and installation of well chambers for the six extraction wells; and
3. supply and installation of safety landings and wet well platform.

##### B. Technical Requirements Specified In Other Sections

The following items of work shall be carried out in accordance with the technical requirements of the Sections noted below:

- |                                     |               |
|-------------------------------------|---------------|
| 1. Excavation and Backfill          | Section 02220 |
| 2. Supply and placement of concrete | Section 03300 |

#### 1.02 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Certification

The Contractor shall submit manufacturer's certification that precast units meet requirements of this Section minimum 14 days in advance of delivery to Site.

##### C. Manufacturer's Data

The Contractor shall submit manufacturer's drawings and other pertinent data on specified materials minimum 14 days in advance of delivery to Site.

#### 1.03 PRODUCT DELIVERY AND HANDLING

##### A. Storage and Handling

Precast units shall be stored and handled in a manner to prevent damage to sections or ends.

Precast units shall be handled by purpose made lift eyes or holes.

#### 1.04 JOB CONDITIONS

##### A. Environmental Requirements

Dewatering shall comply with Section 01500. Dewatering of manhole excavations also shall comply with Section 02220. Groundwater encountered during construction of the manholes and the pipe and media drain shall be pumped from the Wet Well to the Trusts on-Site groundwater treatment system by the Contractor, for treatment of groundwater by the Trust prior to off-Site discharge. The Contractor shall supply, operate and maintain all power, pumping and piping to transfer groundwater to the on-Site groundwater treatment facility, including provision of all connections to the groundwater treatment facility as directed by the Engineer.

##### B. Protection

Surface water shall be prevented from entering any open excavation.

Installed units shall be protected from damage and debris shall be prevented from entering system.

##### C. Sequencing and Scheduling

The Contractor shall install the Wet Well, temporary Wet Well dewatering pumps, and piping to the on-Site groundwater treatment facility prior to commencing excavation for other manholes or for the pipe and media drain.

All extraction wells and certain monitoring wells and piezometers within the work area can only be installed by other contractor after the Contractor has completed the pipe and media drain and manhole installations and has regraded and backfilled the Site to the bottom of the final Site cover. It is estimated that other contractor will require two (2) months to install extraction wells, monitoring wells and piezometers after the Contractor has regraded and backfilled the Site to the bottom of the final Site cover. The Contractor shall coordinate the installation of these extraction wells, monitoring wells and piezometers to minimize any delay to the progress of the Works, and shall include this installation time in the Contractor's construction schedule.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

##### A. Precast Manhole Sections

Precast manhole sections shall comply with ASTM C478.

Cement shall comply with ASTM C150, Type IIA.

B. Joints

Joints between precast sections shall be watertight, consisting of 'O'-Ring butyl rubber gasket. Parge six inches above and below the joint with an epoxy paste on inside and outside perimeter of the joint.

C. Ladder Rungs

Ladder rungs shall be billet steel deformed bars complying with ASTM A615 and shall be galvanized in accordance with ASTM A153.

Rungs shall be safety pattern, drop step type.

D. Manhole Covers and Access Door

Manhole covers shall be precast concrete and shall bear evenly on the precast manhole sections.

Covers shall be provided with a 2'6" x 3'0" opening and shall comply with ASTM C478.

Access doors shall be Bilco Pit Door, Model Q-3, equipped with locking device as manufactured by the Bilco Company. Access doors shall be mechanically fastened to the concrete covers.

E. Granular Bedding

Granular bedding shall comply with Section 02220.

F. Concrete

Concrete for manhole benching shall comply with Section 03300.

G. Non-shrink Grout

Non-shrink grout shall be cementitious and non-metallic as approved by the Engineer and suitable for making pipe penetrations in precast structures watertight.

H. Safety Landings and Wet Well Platform

Safety landings and wet well platform shall be grating fabricated from aluminum. Panels shall be banded on all sides, ends and cut outs, and when erected end to end, the longitudinal bars and cross bars in adjacent panels shall be in respective alignment. Grating shall be free of warps. Longitudinal bars shall be parallel and without twists or bends, and with their edges in flat planes and the end in perfect alignment. Hinged grating shall be equipped with 1/2-inch diameter x 18-inch galvanized steel chain and snap hook to hold grating vertically in place during entry.

Safety landing and wet well platform supports shall be fabricated from steel complying with ASTM A36 and shall be heavy duty galvanized.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

The Contractor shall excavate to lines and grades shown on the Drawings in accordance with Section 02220.

### **3.02 INSPECTION**

The Contractor shall obtain approval from the Engineer prior to installing precast base slab on prepared foundation.

### **3.03 INSTALLATION**

#### **A. General**

Units shall be constructed in accordance with details shown on the Drawings, plumb and true to alignment and grade.

Manhole units shall be completed as pipe laying progresses.

Soft and foreign material shall be removed before placing concrete base.

Precast concrete base shall be set on minimum 6-inch layer of granular bedding compacted to 95% of standard proctor density as determined in accordance with ASTM D698.

Granular bedding shall be placed in accordance with Section 02220.

#### **B. Precast Units**

The bottom section of precast units shall be set on granular bedding as shown on Drawings.

The Contractor shall make each successive joint watertight with specified joint material so that the assembled unit is continuous and uniform and that the interior wall surface is free of appreciable irregularities.

Surplus joint compounds shall be cleaned from interior surface of units as work progresses.

Lifting holes shall be plugged with precast concrete plugs set in cement mortar and made watertight.

#### **C. Outlets and Bulkheads**

Stub outlets and bulkheads shall be placed at elevations and in positions indicated on the Drawings.

All pipe penetrations shall be made watertight using non-shrink grout.

All electrical conduits entering the manhole chambers shall extend two inches beyond the inside wall of the manhole chambers.

D. Access Doors

Access doors shall be installed at the concrete cover openings, shall be mechanically fastened to the covers, and shall be watertight in the closed position.

The access doors shall be positioned in the configuration providing maximum positive access to steps.

E. Backfilling

Manholes shall be backfilled with approved native backfill in accordance with Section 02200 and as shown on the Drawings. The Contractor shall place material carefully against structures so as not to damage structures. Repair of damage resulting from backfilling around manholes shall be at the Contractor's sole expense.

F. Benching

Concrete benching shall be installed in the access/maintenance manhole chambers in accordance with Section 02260 and as shown on the Drawings.

3.04 FIELD QUALITY CONTROL

A. Leakage Test

The Contractor shall install watertight plugs or seals on inlets and outlets of each completed manhole and fill with water. Leakage shall not exceed 0.3% of volume of manhole per hour.

If permissible leakage is exceeded, as determined by the Engineer, the Contractor shall correct defects. Following completion of repairs, the Contractor shall repeat the leakage test.

3.05 ADJUSTMENT AND CLEANING

Manholes shall be cleaned of debris and foreign material. Fins and sharp projections shall be removed.

PART 4 - MEASUREMENT AND PAYMENT

4.01 ACCESS AND WET WELL MANHOLES

A. Measurement

Measurement for access and wet well manholes will be made in vertical feet for actual length of manhole installed and measured by the Engineer in place from the underside of the precast manhole to the top of the precast manhole.

B. Payment

Payment for the quantity determined above will be made at the unit price per vertical foot stipulated in the Schedule of Prices for Item J-1 which price and payment shall be

full compensation for the supply of all labor, plant, materials and equipment required for construction of eight access manholes and one wet well manhole for the pipe and media drain; including but not limited to excavating; shoring and bracing; supply and installation of granular bedding; supply and installation of precast concrete sections; covers and Bilco access doors; supply and installation of ladder rungs; sealing pipe penetrations and joints of precast sections; construction of concrete benching inside manholes; leakage testing of each manhole; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.02 EXTRACTION WELL CHAMBERS

##### Payment

Payment for extraction well chambers will be made at the unit price per extraction well chamber stipulated in the Schedule of Prices for Item J-2, which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required for construction of six extraction well chambers, including but not limited to excavation; supply and installation of granular bedding; supply and installation of precast concrete sections and covers; supply and installation of Bilco access doors and ladder rungs; sealing pipe penetrations and joints of precast sections; construction of concrete benching inside chambers; leakage testing of each chamber, backfilling and compaction; and all other miscellaneous items for which separate payment is not provided under other Items.

#### 4.03 SAFETY LANDINGS AND WET WELL PLATFORM

##### Payment

Payment for safety landings and wet well platform will be made at the lump sum price stipulated in the Schedule of Prices for Item J-3, which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required for supply, fabrication and installation of safety landings and wet well platform; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 02831 - CHAIN LINK FENCES AND GATES

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of chain link fences and gates as specified and as shown on the Drawings.

#### 1.02 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Product Data

The Contractor shall submit manufacturer's product data prior to installation of the materials.

##### C. Certification

The Contractor shall submit manufacturer's certification that specified materials were produced and tested in accordance with this Section, prior to installation of the materials.

#### 1.03 PRODUCT DELIVERY AND HANDLING

##### A. Delivery

Chain link fence fabric shall be delivered in firmly tied tight rolls.

Each roll shall be tagged clearly indicating class of coating, specified wire size, mesh size, height of fabric, ASTM A392 and ASTM F668 designation and manufacturer's name.

##### B. Storage and Handling

The Contractor shall store and handle materials in accordance with manufacturer's instructions. In the event of damage, the Contractor shall make repairs or replacements approved by the Engineer.

Damaged zinc-coated surfaces shall be repaired as specified.



## 1.04 JOB CONDITIONS

### A. Protection

The Contractor shall protect zinc coated surfaces from damage and shall protect fencing materials from distortion or bending.

### B. Sequencing and Scheduling

The Contractor shall not commence fence installation until all backfilling is complete.

## PART 2 - PRODUCTS

## 2.01 MATERIALS

### A. Chain Link Fence Fabric

Chain link fence fabric shall comply with ASTM A392 with a uniform 2-inch mesh pattern formed with 9 gage zinc-coated steel wire. All fences shall be 6 feet in height to the top of the fence fabric.

### B. Posts and Rails

Posts and rails shall be galvanized steel pipe, standard weight complying with ASTM A53 and of diameters and lengths shown on the Drawings.

### C. Tension

Tension wires shall be single strand, galvanized steel wire, 6 gage.

### D. Fasteners

Fasteners shall be single strand, galvanized steel wire conforming to requirements of fence fabric, 6 gage.

### E. Tension Bars

Tension bars shall be 1/4 x 3/4-inch minimum galvanized steel.

### F. Fittings and Hardware

Fittings and hardware shall be galvanized malleable iron.

Post caps shall provide a waterproof fit and shall fasten securely over exterior of posts to carry top rail. Turnbuckles shall be drop forged.

### G. Barbed Wire

Barbed wire shall consist of 3 strands of 12 gage galvanized steel wires twisted with 4 points, 14 gage round barbs spaced not more than 5 inches apart, complying with ASTM A121.

H. Extension Arms

Extension arms shall be galvanized malleable iron with eyes to hold top rails and an outward projection to hold barbed wire overhang. Provide projection with equally spaced slots to hold 3 strands of barbed wire spaced 6 inches apart with the topmost barbed wire 12 inches above the fabric. Extension arms shall project from fence at 45 degrees above horizontal.

I. Zinc Coating

Zinc coating shall comply with the following:

1. wire components including fabric, tie wires and tension wire in accordance with ASTM A392, 1.2 oz. of zinc per sq. ft.;
2. posts, rails, frames and braces in accordance with ASTM A53 except that the zinc coating shall average no less than 2.0 oz. of zinc per sq. ft. and no single coating shall show less than 1.8 oz. of zinc per sq. ft.;
3. other fittings and hardware in accordance with ASTM A153.

J. Field Repair Coating

Field repair coating for galvanized surfaces shall comply with ASTM A780.

K. Concrete

Concrete for fence posts shall comply with Section 03300.

L. Gates

Gates shall be double, with an overall 16-foot opening. Gate frames and bracing shall be constructed of galvanized steel pipe, standard weight and shall comply with ASTM A53. Frames shall be of diameter shown on the Drawings and shall be adequately braced. Nominal 2-inch O.D. pipe (2.72 lbs/ft) shall be used for gate frames and 1 5/8-inch O.D. pipe (2.27 lbs/ft) shall be used for braces.

Gates shall be fabricated to shapes shown on the Drawings with electrically welded joints and hot dip galvanized after welding. Fence fabric shall be fastened to the gates on the outside, with twisted selvage at top. Fabric and other components used on gates shall match those of fence and shall be of same quality. Gates shall be furnished with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate. Gates shall be capable of opening 180 degrees in an outward direction. Double gates shall be furnished with a chain hook to hold gates open, and center rest with drop bolt for closed position.

PART 3 - EXECUTION

3.01 PREPARATION

The Contractor shall remove debris and correct ground undulations along fence lines to obtain a smooth uniform gradient between posts.

The Contractor shall provide maximum 2-inch clearance between bottom of fence fabric and ground surface, except on soft ground where fabric shall extend below grade to compensate for shifting sand or soil.

Fence installation shall not commence until Site grading is complete and installation of soil final cover under fence is complete.

### 3.02 INSPECTION

The Contractor shall provide the Engineer with 24 hours' notice of intention to commence fencing.

### 3.03 INSTALLATION

#### A. Posts

Posts shall be installed along lines shown on the Drawings or as directed by the Engineer.

Post holes shall be excavated to dimensions shown on the Drawings in the line of the fence.

Line posts shall be spaced equidistant at intervals not exceeding 10 feet measured parallel to ground surface grade.

Straining posts shall be spaced at equal intervals not exceeding 80 feet if the distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 100 feet, and at sharp changes in grade.

Corner posts shall be installed where change in alignment exceeds 20 degrees.

End posts shall be installed at end of fence and at buildings.

Gate posts shall be installed on both sides of gate openings.

#### B. Concrete

Concrete shall be placed in accordance with Section 03300 in post holes and posts shall be embedded into concrete to depths shown on the Drawings. Concrete shall be extended 2 inches above ground level and sloped to drain away from posts. Posts shall be braced and held in plumb position and true to alignment and elevation until concrete has set.

Fence fabric shall not be installed until concrete has cured a minimum of 7 days.

Gate center rests shall be cast in concrete. Concrete above ground level shall be domed to shed water. Position for center gate rest shall be determined for double gates.

#### C. Braces

The Contractor shall install a brace between end and gate posts and the nearest line post, placed in center of panel and parallel to ground surface. Braces shall be installed on both sides of corner and straining posts in similar manner.

D. Top Rail

Top rail shall be installed between all posts and fastened securely to posts with waterproof caps.

E. Tension Wire

The Contractor shall install a bottom tension wire, stretched tightly and fastened securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

F. Fabric

The Contractor shall lay out fence fabric and shall stretch the fabric tightly to the tension recommended by the manufacturer and fasten it to end, corner, gate and straining posts with tension bar secured to post with tension bar bands at 14-inch intervals. Knuckled selva shall be installed on bottom of fabric.

Fabric shall be secured to top rails and bottom tension wire with tie wires at 24-inch intervals and to line posts at 12-inch intervals in a vertical taut position. Tie wires shall be given a minimum of two complete twists.

Rolls of fabric shall be joined by weaving a single picket into the ends of the rolls to form a continuous mesh.

G. Barbed Wire

Barbed wire shall be stretched tightly through slots in extension arms and tied securely at ends using barbed wire bands.

H. Extension Arms

Barbed wire extension arms shall be turned outward away from the fenced area. The Contractor shall use vertical extensions on gates, end and corner posts.

I. Caps

Caps shall be installed on the top of gate posts, gate frame extensions supporting barbed wire, and on any posts which are not fitted with barbed wire extension arms.

J. Gates

The Contractor shall install 16-foot wide gates at the locations shown on the Drawings, or as directed by the Engineer, true to opening and plumb in a closed position. Gates shall be hung with specified fastenings with 2-inch clearance above finished grade as shown on the Drawings or as specified by the Engineer.

3.04 ADJUSTMENT AND CLEANING

The Contractor shall repair damaged galvanized surfaces in accordance with ASTM A780.

Field repair coating shall be applied to damaged galvanized surfaces at dry film thickness at least equal to specified galvanized coating thicknesses.

## **PART 4 - MEASUREMENT AND PAYMENT**

### **4.01 CHAIN LINK FENCE**

#### **A. Measurement**

Measurement for chain link fence will be made at the actual number of lineal feet of fence installed as measured in place by the Engineer along the centerline of the fence continuously through posts and excluding gate openings.

#### **B. Payment**

Payment for the quantity determined above will be made at the unit price per lineal foot stipulated in the Schedule of Prices for Item K-1 which price and payment shall be full compensation for supply and installation of chain link fence, including all posts, braces, rails, tension wire, fence fabric, barbed wire, extension arms, caps; excavation and backfilling; supply and installation of concrete; connecting to existing fencing; and all other miscellaneous items for which separate payment is not provided under other Items.

### **4.02 16-FOOT GATES**

#### **A. Measurement**

Measurement for 16-foot gates will be made at the actual number of 16-foot gates installed as measured in place by the Engineer.

#### **B. Payment**

Payment for the quantity determined above will be made at the unit price per gate stipulated in the Schedule of Prices for Item K-2 which price and payment shall be full compensation for supply and installation of 16-foot gates; excavation and backfilling; supply and installation of concrete; connecting to fencing; and all other miscellaneous items for which separate payment is not provided under other Items.

**END OF SECTION**

## SECTION 02900 - LANDSCAPING

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of landscaping as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. topsoiling of areas to receive vegetative cover;
2. fertilizing, seeding and mulching for areas to receive vegetative cover;
3. restoration of existing grassed areas which have been damaged during the prosecution of the Works; and
4. maintenance of vegetative cover.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

1. 18-inch thick loam soil final cover, Section 02264.

#### 1.02 QUALITY ASSURANCE

##### A. General

Package standard products shall be with manufacturer's certified analysis. For other materials, the Contractor shall provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Analytical Chemists, wherever applicable or as further specified.

##### B. Supplier-Installer Qualifications

The Contractor shall employ only experienced personnel who are familiar with the required work. The Contractor shall provide adequate supervision by a qualified foreman.

##### C. Tolerances

The Contractor shall construct the topsoil layer subcomponents of the soil final cover system to the dimensions, lines and elevations as detailed on the Drawings.

1.03 **SUBMITTALS**

A. **General**

The Contractor shall comply with Section 01300.

B. **Source of Topsoil**

The Contractor shall submit to the Engineer the location of the proposed source of topsoil and test results confirming suitability of topsoil at least 14 days prior to commencing topsoiling activities.

C. **Seed Certification**

The Contractor shall submit Certificates from seed vendors stating botanical and common name, percentage by weight and percentage of purity, germination, and weed seed for each species.

1.04 **PRODUCT DELIVERY AND HANDLING**

A. **Delivery**

Grass seed shall be delivered in original containers showing:

1. analysis of seed mixture;
2. percentage of pure seed;
3. year of production;
4. net weight;
5. date when tagged and location;
6. percentage germination; and
7. name and address of distributor.

Mulch shall be delivered in moisture-proof containers showing manufacturer, content and net weight.

Fertilizer and lime shall be delivered in waterproof bags showing weight, analysis and name of manufacturers.

Topsoil shall be delivered in vehicles free of deleterious materials.

B. **Storage and Handling**

Materials shall be stored in accordance with manufacturer's instructions and in a manner to prevent damage or deterioration.

Seed which has become wet, mouldy or otherwise damaged in transit or storage shall be removed from the Site.

Seed, fertilizer and lime shall be stored in weatherproof containers.

Equipment and methods of handling material shall be such as to prevent contamination by foreign material, intermixing, segregation and breakage.

Stockpiles of topsoil shall be situated so as not to obstruct natural drainage or cause off-Site environmental damage.

The Contractor shall provide and maintain access to stockpile areas, shall stockpile materials in a manner to prevent segregation and upon completion of the Work shall leave stockpile sites in a tidy, well drained condition, free of standing surface water and stockpiled material.

All stockpiles on the Site shall be in approved locations designated by the Engineer.

#### 1.05 JOB CONDITIONS

##### A. Environmental Requirements

Material shall not be applied over snow, ice or standing water.

The Contractor shall not apply seed slurry when wind conditions are such that material would be carried beyond designated area or that materials would not be uniformly applied.

##### B. Protection

The Contractor shall protect all structures, fences, monitoring wells, piezometers, manholes, access roads, and landscaped areas from drainage during performance of the Works.

##### C. Sequencing and Scheduling

The Contractor shall sequence and schedule his activities to ensure permanent vegetative cover shall be accomplished within 10 days after loam soil final cover has been completed.

Fertilizer shall be applied at least one week after application of lime.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

##### A. Topsoil

Topsoil shall be obtained from an approved off-Site source.

Topsoil shall:

1. be capable of supporting vegetative growth;
2. be friable and loamy, non-swelling compatible material with permeability of  $1 \times 10^{-4}$  cm/sec or less,
3. be free of debris, objectionable weeds and stones,



4. contain no toxic substances that may be harmful to plant growth,
5. have pH in range 6.0 to 7.0,
6. have conductivity less than 0.5 millimhos per centimeter, and
7. have a minimum organic matter content of 2.75 percent (organic matter content may be raised by additives as approved by Engineer).

Imported topsoil shall be obtained from an area free from growth of Quackgrass, Japanese Clover, Horsetail, Morning Glory, and other persistent weed plants. Topsoil shall not be obtained from swampy areas and shall not be infested with seeds of noxious weeds.

Topsoil shall be inspected and approved by the Engineer prior to delivery to the Site.

Imported soil materials shall be free of unsuitable materials as determined by the Engineer. Unsuitable materials include the following:

1. frozen material or material containing snow or ice;
2. clays which are classified as inorganic clays of high plasticity in accordance with ASTM D2487;
3. soft and/or organic clays and silts of low strength;
4. frost susceptible silts or clays;
5. swelling clays;
6. rock and lumps of material with dimensions greater than 6 inches for backfill of deep excavation areas or 1 1/2 inches for backfill of the upper 6 inches of any excavation area, measured through any axis before compaction;
7. trees, stumps, branches, or any other wood or lumber;
8. wire, steel, cast iron, cans, drums or any other foreign materials; and
9. material containing hazardous or toxic constituents at hazardous or toxic concentrations.

**B. Fertilizer**

Fertilizers for topsoil enhancement shall be Grade 10-20-20.

Fertilizer for hydraulic seeding shall be complete synthetic, slow release fertilizer with maximum 35 percent water soluble nitrogen. Fertilizer ratio and application rate shall be based on soil analysis and shall be determined by the Contractor and approved by the Engineer.

**C. Lime**

Lime shall be ground agricultural limestone containing minimum 85 percent of total carbonates graded in accordance with the following requirements:

***Percent Passing by Weight***

***Sieve Size***

90%  
50%

No. 18  
No. 120

D. Grass Seed

Grass seed shall be obtained from an approved seed house and have germination of 75 percent and minimum purity of 97 percent.

E. Mulch

Mulch materials shall be wheat straw free from weeds and all other foreign matters. Mulch shall be used dry.

F. Water

Water shall be potable and free of impurities that would inhibit germination.

2.02 MIXES

Grass seed mixture and seeding rate for all areas as specified or shown on the Drawings shall be:

1. Kentucky Bluegrass - 80 lb/acre
2. Creeping Red Fescue - 40 lb/acre
3. Perennial Ryegrass - 15 lb/acre
4. Seed Rate - 135 lb/acre

PART 3 - EXECUTION

3.01 PREPARATION

Immediately prior to placing topsoil, the existing surface shall be scarified to provide a good bond with the topsoil.

Unsuitable material and soil contaminated with toxic materials shall be removed and disposed of as directed by the Engineer.

All surfaces shall be graded to eliminate uneven areas and low spots and to ensure positive drainage.

3.02 INSPECTION

The Contractor shall obtain approval of surfaces from the Engineer prior to topsoiling and seeding.

### 3.03 INSTALLATION

#### A. Topsoil

Topsoil shall only be applied when it is dry enough to work without damaging the soil structure. A uniform application to the depth required to achieve a 6-inch thick (settled) layer shall be placed. All stones larger than two inches across any axis, other debris and unsuitable material shall be removed.

#### B. Fertilizer and Lime

Limestone and fertilizer shall be applied according to soil test or as follows:

1. Lime: 2 tons per acre
2. Fertilizer: 300 lbs. per acre, 10-20-20 or equivalent

Lime shall be applied at specified rate determined by the Contractor from soil sample tests to ensure that topsoil is within specified pH range.

The Contractor shall mix lime into full depth of topsoil prior to application of fertilizer.

The Contractor shall spread fertilizer uniformly over entire area of topsoil at the specified rate and shall mix fertilizer thoroughly to full depth of topsoil.

#### C. Fine Grading

The Contractor shall fine grade the surface free of humps and hollows to eliminate rough spots and low areas and to ensure positive drainage.

The Contractor shall prepare a loose friable bed by means of cultivation and subsequent raking.

The surface shall be rolled to consolidate topsoil for areas to be seeded leaving surface smooth, uniform, firm against deep foot printing and with a fine loose texture.

#### D. Seeding

The Contractor shall apply seed when winds do not exceed 5 mph using equipment suitable for area involved to the approval of the Engineer.

Quantities of material shall be measured by weight or weight-calibrated volume measurement.

The Contractor shall charge the seeder with water, mulch, seed, fertilizer and mix thoroughly. Fertilizer rate shall be based on soil analysis by the Contractor. Material shall be pulverized where necessary and added slowly into seeder under agitation.

Erosion control agent shall be added into seeder and mixed thoroughly to complete the seeding slurry.

The Contractor shall apply complete seeding slurry at the following rate per acre:

- |    |                             |              |
|----|-----------------------------|--------------|
| 1. | Seed (mixture as specified) | 135 lbs      |
| 2. | Mulch                       | 900 lbs      |
| 3. | Erosion Control Agent       | 270 lbs      |
| 4. | Water, minimum              | 2600 gallons |

Applications shall be blended into existing, adjacent grass areas to bond new growth to existing, adjacent areas or to previous applications to form uniform surfaces.

E. Maintenance

Soil shall be kept moist during germination period and grassed areas shall be adequately watered until accepted by the Engineer.

Water shall be applied to ensure moisture penetration of three to four inches. Sprinkling shall be controlled to prevent washouts.

Grass shall be cut when it reaches height of 2 1/2 inches and shall be cut to height of 1 1/2 inches. Clippings shall be removed.

Grassed areas shall be maintained free of pests and disease.

Herbicide shall be applied when it will not cause damage to new grass.

Seeded areas shall be fertilized one month after seeding.

Fertilizer shall be spread evenly and watered in well. Fertilizing shall be postponed until next spring if application falls within 4-week period prior to expected end of growing season in locality.

3.04 FIELD QUALITY CONTROL

Areas will be accepted by Engineer provided that:

1. seeded areas are properly established,
2. surface soil is free of eroded, bare or dead spots and 98 percent free of weeds,
3. no surface soil is visible when grass has been cut to height of 1 1/2 inches,
4. seeded areas have been cut at least twice, the last cut being carried out 24 hours prior to acceptance.

Areas seeded in the fall will be accepted in the following spring one month after start of growing season, provided acceptance conditions are fulfilled.

3.05 ADJUSTMENT AND CLEANING

The Contractor shall clean up immediately, soil, mulch or other debris spilled onto pavement or gravel access roads and dispose of deleterious materials.

The Contractor shall take precautions and prevent contamination by seeding slurry of gravel access roads, structures, signs, guardrails, fences, utilities or other surfaces not specified to be landscaped.

Where contamination occurs, the Contractor shall remove seeding slurry to satisfaction of, and by means approved by the Engineer.

#### **PART 4 - MEASUREMENT AND PAYMENT**

##### **4.01 TOPSOILING AND VEGETATED COVER**

###### **A. Measurement**

Measurement for topsoiling and vegetated cover will be made at the actual number of cubic yards of topsoil and vegetated cover installed as measured in place by the Engineer, calculated using the average end area method from cross-sections taken prior to and following completion of topsoiling and vegetating operations.

###### **B. Payment**

Payment for the quantity determined above will be made at the unit price per cubic yard stipulated in the Schedule of Prices for Item L-1 which price and payment shall be full compensation for the supply of all labor, plant, materials and equipment required to topsoil and vegetate work area; supply and installation of 6-inch topsoil layer, supply and installation of lime, fertilizer, erosion control agent, grass seed, water; testing of soils, maintenance of vegetated areas until acceptance; soil erosion and sediment control; dust control; and all other miscellaneous items for which separate payment is not provided under other Items.

**END OF SECTION**

## SECTION 03300 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of supply and installation of cast-in-place concrete as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. supply and installation of cast-in-place concrete for extraction manhole benching;
2. supply and installation of cast-in-place concrete for protective cap and bedding for pipe and media drain manholes; and
3. supply and installation of cast-in-place concrete for fence posts.

#### 1.02 QUALITY ASSURANCE

##### A. General

Concrete work shall comply with the requirements of ACI 301, except as specified otherwise herein.

The Contractor shall use ACI 347 and ACI SP-4 as a further guideline for the design and construction of concrete formwork.

##### B. Supplier-Installer Qualifications

Concrete shall be obtained from a certified ready-mix supplier approved by the Engineer.

Plant certification shall comply with the National Ready Mixed Concrete Association.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

#### 1.04 PRODUCT DELIVERY

##### A. Delivery

Concrete shall be delivered in accordance with ASTM C94 Clause 10 accompanied by batch ticket information in accordance with ASTM C94, Clause 15.

## **1.05 JOB CONDITIONS**

### **A. Environmental Requirements**

#### **(1) Cold Weather Requirements**

Cold weather requirements shall apply when the air temperature is below 40°F and shall comply with ACI 306.

The Contractor shall obtain approval from the Engineer for proposed equipment and methods before concreting in cold weather.

The Contractor shall use steam at a low pressure or vented-type portable heaters to provide a suitable temperature above 40°F for placing concrete. Heaters shall be blocked up and concrete shall be protected from local concentrations of heat. Salamander type heaters shall not be used.

#### **(2) Hot Weather Requirements**

Hot weather requirements shall apply when the air temperature is above 78°F and shall comply with ACI 305. The Contractor shall obtain approval from the Engineer for proposed equipment and methods before concreting in hot weather.

### **B. Protection**

The Contractor shall protect concrete materials before, during and after installation and protect installed work and materials of other Sections.

The Contractor shall prevent mechanical disturbance of concrete immediately after placement and during the specified curing period. The Contractor shall prevent damage to finished concrete.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

Concrete materials shall comply with ACI 301 except as specified otherwise.

### **2.02 MATERIALS**

#### **A. Formwork**

Formwork material shall comply with ACI 301, Chapter 4 and shall be suitable to achieve the specified finish requirements. Formwork shall be subject to review by the Engineer.

#### **B. Form Ties**

Form ties shall be removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 1/2-inch diameter in concrete surface.

C. Form Coatings or Release Agents

Form coatings or release agents shall not impair or prevent adhesion of required surface treatments and shall be subject to review by the Engineer. When used, the Contractor shall comply with manufacturer's specifications.

D. Cement

Cement shall be gray, Standard Portland cement Type II unless otherwise specified and shall be obtained from a single manufacturing source approved by the Engineer.

Portland cement shall comply with ASTM C150.

E. Aggregate

Aggregates shall be normal density, hard, durable, uncoated, uncracked gravel with specific gravity of approximately 2.6.

Fine aggregate shall comply with ASTM C33.

Coarse aggregate shall comply with ASTM C33.

F. Water

Water shall comply with ASTM C94, Clause 4.1.3 except that it shall be free from injurious amounts of oil, acid, alkali, organic matter, sediment or any other deleterious substance.

G. Admixtures

Chemical admixtures shall comply with ASTM C494.

Air entraining admixtures shall comply with ASTM C260 "Darex AEA" (W.R. Grace Co.) or MB-AE10 (Master Builders) or approved equivalent.

Calcium chloride shall not be used as an admixture.

H. Other Materials

Other materials shall be selected by the Contractor subject to the Engineer's approval prior to use.

2.03 MIXES

Concrete shall be proportioned in accordance with Option A, ASTM C94. The Contractor shall assume responsibility for concrete mix proportions. At least 90% of the design water must be added at the concrete batch plant. Concrete temperature upon delivery to the Site shall be between 60°F and 80°F.



The following class of concrete shall be used in the Works:

Specified Strength	3500 psi
Slump,	2 to 4 inches
Air Content	6% +/- 1% by volume
Size of Coarse Aggregate	3/4 inch

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

##### **A. General**

Facilities, materials and equipment necessary for protection of concrete in place from the effects of hot and/or drying conditions and cold weather conditions as applicable, shall be provided and be on hand prior to start of concrete placement.

##### **B. Methods of Placing, Curing and Protection**

The Contractor shall obtain approval from the Engineer for methods of conveying, spreading, consolidating, finishing, curing and protecting concrete at least 24 hours prior to placing concrete.

#### **3.02 INSPECTION**

The Contractor shall notify the Engineer at least 24 hours in advance of intention to place concrete.

Concrete shall not be placed until the Engineer has inspected foundations, forms, methods of mixing, conveying, spreading, consolidating, finishing, curing and protecting concrete or other work specified or required to ensure the proper execution of the work of this Section.

The Contractor shall notify the Engineer of intention to remove formwork and shall obtain approval from the Engineer prior to proceeding.

#### **3.03 INSTALLATION**

##### **(A) Formwork**

##### **(1) Construction**

The Contractor shall comply with ACI 301, Chapter 4 and as specified herein.

The Contractor shall provide 3/4 x 3/4-inch chamfer on external corners and edges of concrete exposed to view, unless otherwise shown on the Drawings.

The Contractor shall ensure that anchors, inserts, angles and other such items to be set in concrete are properly and adequately secured within the forms.

The Contractor shall construct forms tight fitting to prevent cement migrating out of plastic matrix.

The Contractor shall obtain approval from the Engineer for use of earth forms. The Contractor shall hand trim sides and bottoms and shall remove loose earth from earth forms before placing concrete.

(2) Removal of Formwork

The Contractor shall comply with ACI 301 and as specified herein.

Formwork shall be removed only after concrete has attained sufficient strength to prevent damage to corners and edges and the concrete structure adequately supports its own weight and construction loads likely to be imposed.

Removal of concrete formwork shall not occur for 24 hours following placement of concrete, providing the curing requirements of ACI 301 are satisfied.

Notwithstanding the specified minimum times, the Contractor shall be responsible for any damage or injury to the concrete caused by removing forms prior to the concrete gaining sufficient strength.

B. Cast-In-Place Concrete

(1) General

The Contractor shall place, finish, cure and protect concrete in accordance with ACI 301, except as specified herein.

(2) Curing

Section 12.2.13 of ACI 301 shall be deleted from this Specification. Absorptive mat or fabric specified in Section 12.2.1.2 of ACI 301 shall be applied with generous laps to ensure total coverage. Curing by direct hand sprinkling on concrete will not be a method approved by Engineer.

Curing compounds shall not be used on concrete surfaces to which subsequent concrete, tile, paint or other materials are to be bonded unless otherwise approved by the Engineer.

Curing by continuous sprinkling shall be done in a manner which is not harmful to the finished concrete surface. Initial curing shall be by atomized water spray.

(3) Protection

The Contractor shall protect exposed concrete surfaces from shrinkage cracking whenever the rate of evaporation of surface moisture exceeds the rate of bleeding of the concrete.

(4) Finishing of Unformed Surfaces

Unformed surfaces shall be finished as follows:

1. screed, float and apply steel trowel finish;
2. tool edges and joints; and
3. tolerance shall be 1/4-inch in 10 feet.

Floating shall mean mechanical floating, bull floating or darbying to meet specified tolerance.

(5) Finishing of Formed Surfaces

Formed surfaces shall be finished in accordance with ACI 301, Chapter 9 and as follows:

1. Smooth form finish as specified in ACI 301, Chapter 10 for concrete exposed to view; and
2. Rough form finish for buried concrete as specified in ACI 301, Chapter 10.

3.04 FIELD QUALITY CONTROL

A. General

Evaluation of concrete quality will be the responsibility of the Engineer. Field quality control shall comply with ACI 301, Chapter 16.

The Engineer will sample and test delivered concrete and such tests will be at the expense of the Trust except as specified otherwise. Copies of test reports will be supplied to the Contractor on request.

If any concrete materials or concrete work or any construction methods used do not meet the requirements of this Section, the Engineer may reject immediately, affected materials or work, or may carry out additional measures as specified in Section 17.3 of ACI 301 before deciding whether or not to reject such materials or work. Additional measures and repair of any resulting damage to the Works will be at the expense of the Trust, if tested materials or work meet the requirements of this Section of the Specification and shall be at the expense of the Contractor if tested materials or work do not meet requirements of the Specification.

B. Sampling Concrete

When concrete is conveyed from delivery equipment to point of deposition, samples will be taken at point of deposition.

C. Testing By Engineer

Testing by the Engineer or failure to detect defective work shall not prevent rejection when defect is discovered, nor shall it obligate the Trust for final acceptance.

The following tests will be performed by the Engineer:

1. securing composite samples in accordance with ASTM C172;
2. molding and securing specimens from each sample in accordance with ASTM C31;
3. compressive strength in accordance with ASTM C39 except as follows:
  1. two specimens shall be tested at 7 and 28 days, and

2. one strength test for each 50 cubic yard or fraction thereof of each mix placed in any one day;
4. slump for each strength test in accordance with ASTM C143 except as follows:
  1. slump test shall be determined at the beginning of each, the middle of, and the end of a particular mixer/ agitator truck as determined by the Engineer, and
  2. whenever consistency of concrete seems to vary;
5. total air content for each strength test in accordance with ASTM C231 or ASTM C173 as determined by the Engineer;
6. temperature of concrete sample and mixing water for each strength test or as required; and
7. temperature of aggregates, cement, water and the mixture thereof at batch plant as required.

#### PART 4 - MEASUREMENT AND PAYMENT

No separate measurement and payment will be made for work under Section 03300. Payment for concrete work will be included under payment items of other Sections where concrete is required.

END OF SECTION

## SECTION 15050 - MECHANICAL

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

The work of this Section consists of the supply and installation of mechanical materials and equipment as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. supply and installation of wet well electric submersible pumps with associated controls, piping and valves;
2. supply and installation of six extraction well electric submersible pumps, with associated controls, piping and valves; and
3. supply and installation of liquid level controls in eight access/maintenance manholes for pipe and media drain collection systems.

##### B. Related Work Specified In Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

Electrical

Section 16050

##### C. Technical Requirements Specified In Other Sections

The following items of work shall be carried out in accordance with the technical requirements of the Sections noted below:

Pipe Flushing

Section 02701

##### D. Quality Assurance

The Contractor shall test operate all pumping units, control valves, and gauges installed as part of the Contract in the presence of the Engineer and confirm in writing that the equipment has been satisfactorily tested.

#### 1.02 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Shop Drawings

The Contractor shall submit to the Engineer, all shop drawings which are required to complete the specified mechanical works.

C. Pipe Hangers and Supports

The Contractor shall submit to the Engineer a drawing showing all hangers and supports for piping work and equipment for approval.

D. Operation and Maintenance Instructions

Upon completion of all work the Contractor shall submit to the Engineer six complete sets of the manufacturers operating and maintenance manuals including performance data and spare parts lists on all materials, equipment and systems installed.

1.03 PRODUCT DELIVERY AND HANDLING

A. Delivery

Delivery of equipment to the Site shall be arranged as specified in Section 01015.

All materials shall be jointly inspected by the Engineer and the Contractor for damage in transit. No defective material shall be delivered to the Site and materials found defective at any time shall be removed immediately and replaced at the Contractor's sole expense.

B. Storage and Handling

The Contractor shall store all mechanical equipment and materials in dry locations in a manner satisfactory to the Engineer. The Contractor shall be responsible for the proper on-Site storage and protection from damage of equipment and materials to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.01 GENERAL

All equipment shown on the Drawings and/or specified herein as necessary for a completely functional installation shall be supplied, installed and tested by the Contractor. Where equipment is specified by manufacturer, equipment of equal quality may be used subject to written approval by the Engineer.

2.01 MATERIALS

A. Pipe and Fittings

(1) High Density Polyethylene Pipe (HDPE)

High density polyethylene pipe (HDPE) and fitting material shall conform to the cell classification PE 355434C as defined in ASTM D 3350.

(2) HDPE Fittings

HDPE fittings shall be butt fusion, molded fittings, complying with ASTM D3261.

(3) HDPE Pressure Rating

HDPE pipe and fittings shall be SDR 11.0 (160 psi), complying with ASTM F714.

(4) Steel Piping

Steel piping shall comply with ASTM A53, Grade A Type S, Schedule 40, and shall be galvanized.

(5) Steel Pipe Fittings

Fittings shall be fabricated of steel to dimensions specified in the latest revision of ANSI B16.11 and a diameter and grade equal to that of the pipe being used.

B. Extraction Well Electric Submersible Pumps

The six electric submersible well pumps shall have a capacity of 1.2-7 gallons per minute (gpm) at 180-250 feet total dynamic head (TDH) and shall be stainless steel, as manufactured by Grundfos, model 5E8, with single phase, 230 volts, 1/3 horsepower, Franklin motor.

C. Wet Well Electric Submersible Pumps

The two electric submersible wet well pumps shall have a capacity of 40-75 gallons per minute (gpm) at 235-300 feet total dynamic head (TDH) and shall be stainless steel as manufactured by Grundfos Model 60S50-9 with 3 phase, 230 Volts, 5 horsepower, Franklin motor.

D. Pitless Adaptor

Pitless adaptor shall be Model J, welded-on type, for 8-inch well casing, drop pipe size as indicated on the Drawings, as manufactured by Maass-Division of Surinak Engineering and Manufacturing Co.

E. Gate Valves

All control gate valves shall be sized and located as shown on the Drawings. Each valve shall be all brass, threaded, rated at a minimum 200 psi, equipped with sampling device as manufactured by Milwaukee Valve Co.

F. Flow Meters

All flow meters shall be sized and located as shown on the Drawings.

Flow meter shall be oscilating piston type Model OP, bronze body, kynow piston, flanged ends, equipped with Model PFT-420 flow transmitter; remote reading

Model ER-7R single indicator for flow rate and Model ER-7R single indicator for totalized flow as manufactured by Badger Meter Inc.

G. Flow Control Valve

Flow control valves shall be model and size as shown and indicated on the Drawings.

Flow control valve shall be Series 44 ball valve, S.S. body, viton seal, screwed ends equipped with HQ99 adjustable electric controller and electric activator as manufactured by Worcester Controls.

H. Liquid Level Controls

- a) Liquid level controls to be installed in extraction wells shall be Wire Suspension Electrodes, Type E-IS with shield, brass material, equipped with cord grip, electrode holder and Type SW suspension wire, as manufactured by Magnatek Controls, B/W Controls Co.
- b) Liquid level controls to be installed in wet well and in access/maintenance manholes shall be Liquid Level Float Switches Model 7010 equipped with cord grip and wall mounted bracket as manufactured by Magnatek Controls, B.W Controls Co.

Liquid level sensors for pump controls and high level alarm required under these specifications shall be located as shown on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

All pipes, valves, fittings and pumping units shall be installed according to the lines and elevations and dimensions as shown on the Drawings. All dimensioned pipes and fittings shall be installed before fitting make-up pieces and the whole shall be joined so that no stress or strain is created in the lines and associated fittings due to forcing parts into position. All pipes shall be carefully aligned and supported before joints are securely connected.

B. Pipe Hangers and Supports

All hangers required for piping shall be furnished and installed by the Contractor. Hangers and brackets shall be provided as necessary to support the piping in accordance with good engineering practice. The Contractor shall submit to the Engineer a drawing showing all hangers and supports for approval prior to any piping work.

C. Painting

The Contractor shall furnish all labor, materials and equipment to clean and paint all steel piping and valves. The painting shall be in accordance with Steel Structures Painting Council (SSPC), Paint Application Specification No. 1 (PA1) for Shop, Field



and Maintenance Painting. Kop-Coat, Inc. painting systems are approved for the metal surfaces:

<i>Product</i>	<i>Number of Coats</i>	<i>Thickness</i>
Shop Primer: Kop-Coat 340 Gold Primer	1	2.0 mil
Field Primer: Kop-Coat 340 Gold Primer	1	2.0 mil
Finish: Kop-Coat Hi-Gard Epoxy	1	5.0 mil
Kop-Coat Super Hi-Gard Epoxy	1	5.0 mil

Prior to application of primer use Kop-Coat Passivator.

Tremec Company, Inc. painting systems are approved equal.

### 3.02 FIELD QUALITY CONTROL

#### A. General

The Contractor shall provide labor, equipment and materials required to perform hydrostatic and leakage tests herein specified. The Contractor shall notify the Engineer at least 24 hours in advance of all proposed tests. The Contractor shall perform tests in the presence of the Engineer.

The Contractor shall test at one time as much of the piping system as practical and authorized by the Engineer.

Before testing, the Contractor shall bed and cover pipe to prevent movement or snaking of pipe line when test pressure is applied.

Air shall be expelled from piping system by slowly filling system with potable water. The Contractor shall ensure that all air is removed prior to applying test pressure.

#### B. Leakage Test

The Contractor shall apply a leakage test pressure of 100 psi, for a period of two hours.

There shall be no leaks in any aboveground piping.

The Contractor shall locate and repair defects if leakage is detected.

The Contractor shall repeat test until leakage is within specified allowance for full length of line.

3.03 ADJUSTMENT AND CLEANING

On completion, pipes shall be cleaned by flushing as specified in Section 02701.

3.04 OPERATION AND MAINTENANCE INSTRUCTIONS

Upon completion of all work the Contractor shall fully instruct the Engineer in the operation and maintenance of all materials, equipment and systems installed under this Section of the Specifications.

PART 4 - MEASUREMENT AND PAYMENT

4.01 PIPING, MECHANICAL AND ELECTRICAL COMPONENTS FOR  
WET WELL, ACCESS MANHOLES AND EXTRACTION WELLS

Payment

Payment for the piping, mechanical and electrical components for wet well, access manholes and extraction wells will be made at the lump sum price stipulated in the Schedule of Prices for Item M-1 which price and payment shall be full compensation for supplying all labor, materials and equipment required for installation of all piping, fittings, pumps, valves, meters and liquid level control; performing pressure tests; testing all installed mechanical and electrical components; flushing pipes; painting; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

## SECTION 16050 - ELECTRICAL

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Work Included

Work of this Section consists of the supply and installation of electrical materials and equipment as specified and as shown on the Drawings.

The work includes, but is not necessarily limited to, the following:

1. supply and installation of electrical power and control cable and connections in conduit system between extraction wells, wet well, access manholes and terminal box located in the Treatment Plant;

##### B. Related Work Specified in Other Sections

The following items of work related to work of this Section are specified in other Sections as noted:

Underground piping for conduit system, Section 02701.

#### 1.02 QUALITY ASSURANCE

The Contractor shall comply with all codes applicable to the Works.

The Contractor shall apply for, obtain and pay for all required permits and inspection certificates.

All materials and devices, except items not covered by existing UL standards, shall bear labels of Underwriters Laboratory.

#### 1.03 SUBMITTALS

##### A. General

The Contractor shall comply with Section 01300.

##### B. Code Compliance

The Contractor shall submit copies of all required permits and inspection certificates or other code compliance documents from the code enforcement authorities.

##### C. As-Built Drawings

At the completion of the work, the Contractor shall submit to the Engineer a complete set of marked-up "as-built" drawings of schematics, interconnection, underground conduits and one line diagrams. As-built drawings shall be reserved for complete record of work actually installed and shall be updated as work is completed.

Notations shall be neat and legible. Drawings shall be available to the Engineer at the Site at all times.

D. Acceptance Tests

The Contractor shall submit copies of all test results to the Engineer upon successful completion of the work of this section.

1.04 PRODUCT DELIVERY AND HANDLING

All electrical equipment and supplies shall be stored in dry locations to prevent damage to materials and to protect such equipment from extremes in temperature, moisture and physical harm.

1.05 JOB CONDITIONS

Materials shall be protected before and after installation against moisture, dirt, and damage.

The premises shall be kept clear of undue accumulation of rubbish at all times.

Equipment and fixtures shall be thoroughly cleaned and left in a satisfactory condition for use.

PART 2 - PRODUCTS

2.01 GENERAL

All material and equipment furnished by the Contractor shall be new and of standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.

Where materials, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog number, such designation is for the purpose of establishing a standard of desired quality and style.

Material of the same type or classification and used for the same purpose shall be from the same manufacturer.

No material or equipment of any kind shall be used that has not been approved by the Underwriters Laboratory unless otherwise approved by the Engineer. Each piece of equipment installed shall have marked there-on the name of trademark of the manufacturer and the rating in volts and amperes where it can be readily observed.

2.02 MATERIALS

A. Wire and Cable

All wire shall be UL labeled, and shall conform to current specifications of NEMA and to NFPA 70.

All conductors shall be copper.

Splicing shall not occur except in pullboxes. Splices shall be crimped and have heat shrink protection.

All wiring conductors shall be stranded.

Wire smaller than #12 AWG shall not be used except for control systems. Minimum AC control wire shall be #14 AWG.

Wire and cable shall be color coded as follows:

1. Power - Black
2. Lighting - White - Neutral grounding conductor; Red, Black, Blue - ungrounded conductor
3. Equipment Grounding - Green
4. AC Control Wiring - Red
5. DC Wiring - Blue
6. Interlock Control Circuit - Yellow

B. Wire Markers

Wire markers shall be colored, lettered and numbered, gummed type, impregnated, plastic coated, Brady No. E-500, all-temperature.

C. Warning Tapes

Warning tape shall be plastic magnetic type, 6-inch wide, 5-mil composition film consisting of a metallized foil laminated between two layers of inert plastic film suitable for prolonged use underground and yellow in color with a continuously repeated message in permanent ink warning of buried electric and/or telephone lines. The tape shall be Terratape, "detectable" type.

D. Wire Connections

Control wire and cable terminations, taps, and splices shall be secured with solderless pressure type connectors using a ratchet-type crimping tool. Connectors shall be Thomas & Betts or Burndy, at all screw-type connection points.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wire and Cable Installation

All branch wiring shall be sized and so installed that the voltage drop shall not exceed 3 percent from the panels to the farthest outlet at full load. Circuits sharing a common neutral shall not be connected to the same main phase.

Wiring shall be installed in conduit systems to outlet boxes by using approved methods, lubricants and pull tension.

As far as practicable, all feeder cables shall be continuous from origin to panel termination, without running splices in intermediate pull boxes or splicing chambers except as noted in this specification. Sufficient slack shall be left at the termination to make proper connection.

No splices shall be pulled into a conduit or be so placed as to be inaccessible.

All wiring for systems, controls, etc. shall be identified on each end by a circuit or wire number using Brady wire wrap markers.

Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors.

Wiring shall be identified with permanent indelible identifying markings, either numbered or colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

Phase sequence and color coding shall be maintained throughout.

Conduits shall be complete, properly swabbed and moisture free prior to pulling in conductors. A nylon pull wire shall be installed in all conduits to facilitate future cable pulling by others.

All conductors shall be designated by circuit number and phase at each terminal or splice location. No splices shall be allowed between pull boxes. Conductor ends shall be stripped of insulation without nicking metal. Connections shall be high-conductive and permanent.

B. Grounding

The Contractor shall provide grounding in accordance with the applicable sections of the NEC (NFPA-70-1984) and ground wires shall be run continuous.

All equipment grounding shall be provided as required regardless of whether it has been shown on the Drawings or called for in this Specification.

Grounds shall be arranged so that under normal operating conditions no injurious amount of current will flow in any grounding conductor.

The conduit systems and control circuits shall be grounded. The ground connection to conduit and wiring shall be made at the electrical panel.

Separate ground conductor shall be run in each branch or feeder conduit.

All grounding surfaces shall be thoroughly cleaned before applying the ground connections. All conduit shall be grounded directly or through equipment frames and ground busses to the ground system.

Ground wire splices and taps shall be made by exothermic welds or approved compression type fittings.

Ground wire sizes shall be as specified in Division 250 of the National Electric Code.

All contact surfaces shall be thoroughly clean and bright, before connections are made to insure making good electrical contact.

C. Labeling and Identification

All circuits shall be marked by the Contractor at all circuit junction boxes and pull boxes. All conductors shall be identified by circuit number and phase at each terminal or splice location. Gummed Brady E-500 all temperature, impregnated, plastic coated markers shall be used.

Manufacturers nameplates and labels to be visible and legible after equipment is installed.

Warning signs shall be provided, as specified or to meet requirements of the Trust.

D. Locations

The location of any wiring may be changed by the Engineer if the new location is within a limit of 10-foot radius of the original location. Changes shall be provided without extra cost if required before installation in the original locations.

3.02

FIELD QUALITY CONTROL

On completion, the installation and wiring shall be thoroughly tested by the Contractor using a qualified electrician to determine proper polarity, phasing, freedom from grounds and short circuits, continuity, and operation of equipment, meters, relays, instruments, etc.

Complete test and inspection records shall be made and incorporated into a report which shall be given to the Engineer. All readings taken shall be recorded.

All tests shall be performed in the presence of the Engineer. The Contractor shall give the Engineer sufficient notice of any test, so that he may be present.

All tests shall be scheduled by the Contractor and cleared through the Engineer. No testing of any kind shall be done or scheduled without this clearance.

Arrangements shall be made with the Engineer before any work is done on an energized circuit. There shall be no interruption of energized circuits without previous approved arrangements with the Engineer.

The Contractor shall furnish all instruments and personnel required for tests.

The Contractor shall provide assistance for inspection to the Engineer, and state or local permit inspectors at all times as requested. The Contractor shall remove covers, operate machinery, conduct continuity tests, as necessary to demonstrate quality and adequacy.

The Contractor shall test operate all electrical equipment including service entrance unit; branch feeder; panelboard circuit; control system; and electrical control on installed mechanical equipment as requested.

All cables and equipment shall be tested for grounds and shorts by means of a Megger insulation testing instrument, which shall impress a voltage of not less than 500 volts DC upon the circuit under test. Resistance of wire and cable insulation shall not be less than

1,000,000 ohms. Where tests indicate that the insulation was damaged by handling or during installation, new cable shall be installed at the Contractor's sole expense.

The Contractor shall set breakers and relays as directed by the Engineer so that equipment will be in proper operating condition before being placed in service.

The Contractor shall provide personnel, instruments, meters and equipment as needed to work with the Engineer for checking operation of his equipment.

The Contractor shall check calibration of level of each measuring system at a minimum of five (5) points in their span. This may be done outside of the installation with probes and electronics kept matched.

The Contractor shall check calibration of each flow computer by simulating input signals to the electronics and checking the outputs.

#### **PART 4 - MEASUREMENT AND PAYMENT**

##### **4.01 ELECTRICAL POWER WIRING**

###### **(1) Measurement**

Measurement for electrical power wiring will be made of the actual number of lineal feet of wire installed as field measured by the Engineer horizontally from handhole to handhole or to pump chamber or to the ends of the wiring installed where no handhole or pump chamber exists. No additional measurements will be allowed for slack in wiring, coiled wiring at the points of termination, or for coiled wiring in handholes and pump chambers.

###### **(2) Payment**

Payment for the quantity determined above will be made at the respective unit price stipulated in the Schedule of Prices for Item N-1 which price and payment shall be full compensation for: supplying all labor, plant, materials and equipment required to supply and install wiring as specified in the conduits; performing quality control testing upon completion of installation; and all other miscellaneous items for which separate payment is not provided under other Items.



ELECTRICAL CONTROL WIRING(1) Measurement

Measurement for electrical control wiring will be made at the actual number of lineal feet of wire installed as field measure by the Engineer horizontally from handhole to handhole or to pump chamber or to the ends of the wiring installed where no handhole or pump chamber exists. No additional measurements will be allowed for slack in wiring, coiled wiring at the points of termination, or for coiled wiring in handholes and pump chambers.

(2) Payment

Payment for the quantity determined above will be made at the respective unit price stipulated in the Schedule of Prices for Item N-2 which price and payment shall be full compensation for: supplying all labor, plant, materials and equipment required to supply and install wiring as specified in the conduits; performing quality control testing upon completion of installation; and all other miscellaneous items for which separate payment is not provided under other Items.

END OF SECTION

F

APPENDIX F

QUALITY ASSURANCE PROJECT PLAN  
GROUNDWATER EXTRACTION SYSTEM

**REMEDIAL CONSTRUCTION  
QUALITY ASSURANCE PROJECT PLAN  
GROUNDWATER EXTRACTION SYSTEM**

**Summit National Superfund Site  
Deerfield Township of Portage County, Ohio**

**MAY 1993**

**REF. NO. 2372 (41)**

This report is printed on recycled paper.

**CONESTOGA-ROVERS & ASSOCIATES**

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## **1.0 INTRODUCTION**

### **1.1 BACKGROUND INFORMATION**

The Summit National Superfund Site (Site) is located in Deerfield Township of Portage County, Ohio, at the intersection of Ohio Route 225 and U.S. Route 224, approximately 45 miles southeast of Cleveland, Ohio. The location of the Site is illustrated on Figure 1.1 of the Remedial Construction (RC) Work Plan.

The Site was originally used as a coal strip mine and contained a coal wash pond and coal stockpile, prior to its use by Donald Georgehoff, Summit National Services and/or Summit National Liquid Disposal Services for the operation of a hazardous waste treatment, recycling, storage and disposal facility.

Prior to implementation of remedial work activities, operations at the Site resulted in uncontrolled releases of hazardous materials. Subsequent Site investigations indicated that there was significant contamination in Site soils, and that groundwater contamination existed both on and off Site.

### **1.2 PURPOSE AND ORGANIZATION OF REPORT**

This Remedial Construction Quality Assurance Project Plan (RC QAPP) presents the quality assurance program to be implemented

during construction of the groundwater extraction system at the Site, as detailed in the RC Work Plan, to ensure that the groundwater extraction system is constructed to meet or exceed all design criteria, plans and specifications. This report is organized as follows:

- i) Section 1.0 presents the background information, purpose and organization of the report;
- ii) Section 2.0 provides a description of the project;
- iii) Section 3.0 outlines the project organization and responsibilities;
- iv) Section 4.0 presents the personnel qualifications requirements;
- v) Section 5.0 presents the project meeting requirements;
- vi) Section 6.0 describes the inspection and testing activities required to ensure that construction and materials comply with all design specifications and plans; and
- vii) Section 7.0 describes documentation requirements of construction quality assurance (CQA) activities.

Construction specifications for the Groundwater Extraction System are presented in Appendix E of the RC Work Plan, and also on the "D" Construction Drawings.



## **2.0 PROJECT DESCRIPTION**

The second phase of the Remedial Action (RA) to be implemented at the Site, as required by the Consent Decree, is the construction and commissioning of a groundwater extraction system at the Site, and associated activities. As detailed on Figure 15.1 of the RC Work Plan, the groundwater extraction system must be completed within 18 months of United States Environmental Protection Agency (USEPA) and Ohio Environmental Protection Agency (OEPA) formal approval of the Final Design Report. Installation of the groundwater extraction system phase of the RA consists of the activities detailed in Section 7.1 of the RC Work Plan.

### **3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES**

It is anticipated that the remedial construction activities will be initiated by Conestoga-Rovers & Associates (CRA) on behalf of the Summit National Facility Trust (SNFT). The project organization chart is presented on Figure 3.1. A brief description of the duties of the key personnel are presented below.

#### **3.1 PROJECT MANAGER**

The duties of the Project Manager are as follows:

- i) provides overall project management;
- ii) ensures professional services by CRA are cost effective and of highest quality;
- iii) ensures all resources of CRA are available on an as-required basis;
- iv) participates in key technical negotiations with United States Environmental Protection Agency (USEPA) and Ohio Environmental Protection Agency (OEPA); and
- v) provides managerial and technical guidance to CRA's Project Coordinator.

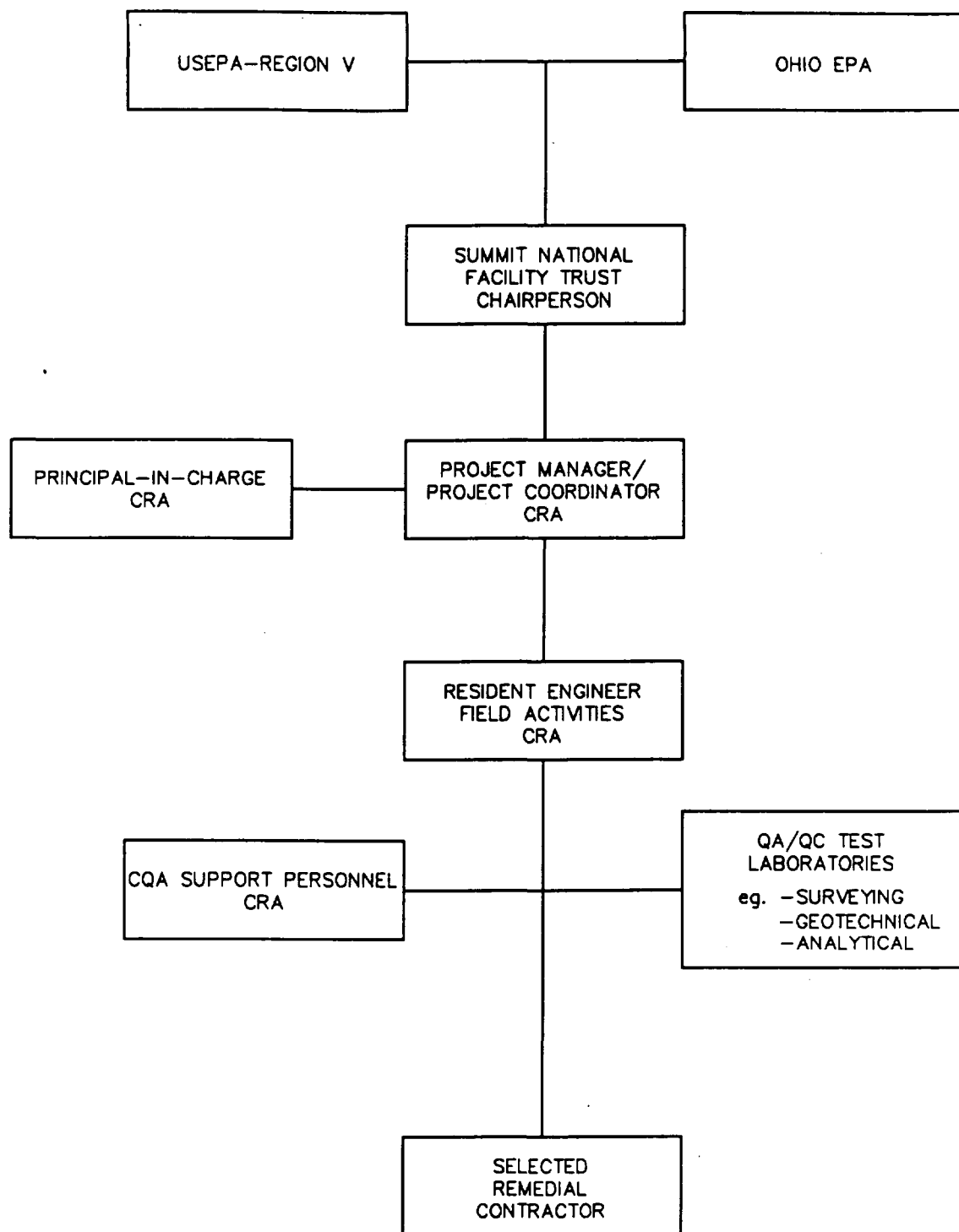


figure 3.1

PROJECT ORGANIZATION  
REMEDIAL CONSTRUCTION ACTIVITIES  
SUMMIT NATIONAL SUPERFUND SITE  
*Deerfield Township of Portage County, Ohio*

**CRA**

### 3.2 PROJECT COORDINATOR

The duties of the Project Coordinator are as follows:

- i) provides day-to-day project management;
- ii) provides managerial guidance to CRA's technical group;
- iii) provides technical representation at meetings as appropriate;
- iv) retains testing firms to perform quality control field/laboratory tests;  
and
- v) prepares and reviews reports.

### 3.3 RESIDENT ENGINEER

The duties of the Resident Engineer are as follows:

- i) reports to CRA Project Coordinator;
- ii) provides immediate supervision of all on-site project activities;
- iii) provides field management of CQA activities;
- iv) reviews design criteria, plans and specifications for clarity and completeness so that the RC QAPP can be implemented;
- v) informs CQA support personnel on CQA requirements and procedures;
- vi) ensures that regular calibration of testing equipment is conducted and recorded;
- vii) ensures that all site activities are recorded daily and maintained;
- viii) ensures that CQA test results are accurately recorded;

- ix) identifies work that should be accepted, rejected, or uncovered for observation, or that may require special testing, inspection, or approval;
- x) rejects defective work and verifies that corrective measures are implemented; and
- xi) interacts daily with the contractor to provide assistance in modifying the materials and work to comply with the specified design.

The individual designated to be the Resident Engineer will be specified by CRA prior to commencement of the construction activities.

#### 3.4 COA SUPPORT PERSONNEL

The duties of the CQA Support Personnel are as follows:

- i) reports directly to the Resident Engineer;
- ii) conducts CQA tests and inspections as indicated in this RC QAPP;
- iii) accurately records test results and inspections;
- iv) calibrates testing equipment as required;
- v) maintains testing equipment in good working order; and
- vi) immediately notifies Resident Engineer whether or not test results comply with design specifications.

### 3.5 QA/QC TEST LABORATORIES

QA/QC Test Laboratories that will conduct CQA Quality Control tests will be identified by CRA prior to the commencement of the construction activities. The duties of the QA/QC Test Laboratories are to provide QA/QC testing of construction activities, as requested by the Resident Engineer, to confirm construction activities have been implemented according to the construction specifications and drawings.

### 3.6 CONTRACTOR

The duties of the Contractor, as they relate to QA/QC, are as follows:

- i) retains qualified testing firms (for example laboratory, geotechnical), for testing of materials and workmanship to ensure that materials meet specified requirements;
- ii) submits samples and/or materials for testing to determine if samples/materials meet specified requirements, and submits results directly to the Resident Engineer;
- iii) records daily CQA activities in the Contractors Site log book and submits a "Daily Construction Quality Control Report" (see Section 7.2) to the Resident Engineer; and
- iv) carries out construction activities according to design specifications.

#### **4.0 PERSONNEL QUALIFICATIONS**

##### **4.1 RESIDENT ENGINEER**

The Resident Engineer will have the following qualifications:

- i) graduate of a recognized college in a technically related field;
- ii) minimum two (2) years experience in the oversight and implementation of hazardous waste remedial construction and CQA activities; and
- iii) good management and communication skills.

##### **4.2 CQA SUPPORT PERSONNEL**

The CQA support personnel will have the following minimum qualifications:

- i) degree from a recognized college in engineering technology, or equivalent; or a minimum of two (2) years experience in hazardous waste remedial construction and CQA inspection procedures; and
- ii) working knowledge of all relevant codes and regulations concerning material and equipment installation, observation and testing procedures, equipment, documentation procedures, and site safety.

#### 4.3 CONTRACTOR

The selected contractor will assign experienced personnel to supervise the implementation of each of the remedial construction activities specified in the RC Work Plan. In particular, the selected contractor will assign experienced personnel to the following critical remedial construction activities:

- i) demolition of Watson house;
- ii) installation of pipe and media drain and manholes;
- iii) installation of extraction wells, monitoring wells and piezometers;
- iv) excavation and relocation of contaminated soils and sediments; and
- v) installation and commissioning of mechanical and electrical components.

Experienced personnel will have a thorough knowledge of testing procedures, equipment and documentation procedures required for implementation of the remedial construction activities.

The selected contractor will designate an on-Site Project Manager empowered to act on behalf of the contractor in all matters pertaining to the remedial construction activities.



## **5.0 PROJECT MEETINGS**

Project meetings as detailed herein will be held during the remedial construction period to ensure that all tasks are accomplished according to schedule and that they are completed in accordance with the remedial construction plans and specifications. These progress meetings will be attended by the Project Manager, Project Coordinator, Resident Engineer, Contractor Representative, SNFT, USEPA and/or OEPA as detailed below.

### **5.1 PRECONSTRUCTION MEETING**

**Purpose:** To resolve any uncertainties in the remedial construction plans and specifications, and to review levels of responsibility, reporting requirements, and health and safety requirements.

**Present:** Project Coordinator, Resident Engineer, CQA Support Personnel, Contractor Representative.

**Topics:**

- Present RC QAPP, Contractors Site-specific Health and Safety Plan, and other relevant documents.
- Review the activities to be conducted during the remedial construction.
- Review roles of each organization relative to the design criteria, plans and specifications within the RC QAPP.

- Determine any need to modify the RC QAPP that may be necessary to ensure that the construction is performed to meet or exceed the specified design criteria.
- Review lines of authority and communication.
- Discuss the established procedures or protocol for observations and tests including sampling strategies.
- Discuss the established procedures or protocols for handling construction deficiencies, repairs and retesting.
- Review methods for documenting and reporting inspection data.
- Review methods for distributing and storing documents and reports.
- Review work area delineation, security and safety protocol.
- Discuss the location for storing construction equipment and materials, and the protection of these items during inclement weather.
- Discuss the protection of uncompleted construction work during off hours and during inclement weather.
- Conduct a Site tour to review construction areas, safety areas, and equipment and stockpile storage locations.

## 5.2 DAILY PROGRESS MEETINGS

**Purpose:** To daily review work schedule progress. This meeting is intended to be an informal meeting held at the end of each work day or at the start of each work day.

**Present:** Resident Engineer, Contractor Representative

**Topics:**

- Review previous day's activities and progress.
- Review work location and activities for upcoming day.
- Review health and safety deficiencies from the previous work day and review health and safety requirements and potential problems for the next day's activities.
- Review Contractor's personnel and equipment assignments for the upcoming day.
- Discuss any potential construction problems.

### 5.3 WEEKLY PROGRESS MEETINGS

**Purpose:** To provide an update of work schedule progress on a weekly basis, and identify schedule slippages and efforts required to get back onto schedule, if required.

**Present:** Resident Engineer, CQA Support Personnel (optional), Project Coordinator (optional), Project Manager (optional), Contractor Representative, Site Safety Officer (optional).

**Topics:**

- Health and Safety report for previous week's activities and forthcoming week activities.
- Review work activities for the previous week.

- Comparison of actual progress to scheduled work activities, noting of schedule slippages and actions to be implemented to rectify schedule slippages.
- Review work activities for the next week.
- Review potential construction problems and proposed solutions.

#### 5.4 MONTHLY PROGRESS MEETINGS

Purpose: To provide a remedial construction progress update to SNFT, USEPA and OEPA.

Present: Project Manager, Project Coordinator, Resident Engineer, SNFT, Contractor's Representative, USEPA and OEPA.

Topics:

- Health and Safety report for previous month's activities.
- Review of the work activities for the previous month.
- Comparison of actual progress to scheduled work activities, noting of schedule slippages and actions implemented to rectify schedule slippages.
- Summarize work activities scheduled for the next month.
- Review potential remedial construction problems/conflicts for the next month's remedial construction activities and proposed solutions to the potential problems/conflicts.

## 5.5 PROBLEM OR WORK DEFICIENCY MEETINGS

**Purpose:** If a problem or deficiency is present or likely to occur.

**Present:** Resident Engineer and CQA Support Personnel,  
Contractor Representative (optional if major problem  
directly related to his work)

**Topics:**

- Define and discuss problem or deficiency.
- Review alternative solutions.
- Develop and implement a plan to resolve the problem or deficiency.

For all meetings held on Site during the remedial construction, with the exception of the daily progress meetings, minutes will be taken by the Resident Engineer. Copies of the minutes will be forwarded to SNFT and all organizations present at the meetings.

## 6.0 INSPECTION AND TESTING ACTIVITIES

### 6.1 SCOPE

Throughout the implementation of the remedial construction activities there will be numerous inspections and testing requirements for specific work tasks. The inspection and testing requirements will ensure compliance with the remedial design as presented in the construction specifications, as well as ensure completion of the work tasks to the highest level of quality.

Inspections and testing will provide a qualitative means of monitoring the quality and progress of work performed.

The components of each work task that will require some form of inspection or testing as described by the RC QAPP are as follows:

- i) Buried Conduits
  - trench excavation
  - installation of conduits
  - backfilling and grading
  
- ii) Manholes and Wet Well
  - installation of precast manholes and chambers
  - placement of grout
  - placement of concrete

iii) Demolition and Removal Activities

- clearing and grubbing
- Watson house demolition

iv) Mechanical Components

- groundwater extraction equipment including pumps, flow meters, gate valves, flow control valves and other appurtenances, etc.

v) Electrical Components

- groundwater extraction equipment including liquid level flow switches, control wires, suspended electrodes, etc.

vi) Regrading and Backfilling Activities

- level control
- compaction

vii) Vegetation

- topsoiling
- seeding
- fertilizing
- watering

viii) Extraction Well, Monitoring Well and Piezometer Installation

- location and level
- installation/abandonment
- well development
- sampling and testing

ix) South Ditch and East Ditch Relocation

- alignment and level
- compaction
- riprap supply and placement

x) Pipe and Media Drain Installation

- alignment and level
- excavation and shoring
- pipe and media drain installation
- backfilling

6.2 INSPECTIONS

Throughout the period of remedial construction the quality of work completed and material used for each of the work tasks will be maintained at its highest possible level through regular inspections of the work. Inspections will be completed throughout the construction by the Resident Engineer, CQA support personnel, and representatives of USEPA and OEPA on a periodic basis, if required.

In general, inspections to be conducted by the Resident Engineer and CQA support personnel include the following:

- i) daily inspections of the work progress;



- ii) inspections of material as it is delivered to the Site to check for damage during delivery;
- iii) comparison of the material delivered to the Site to the design specifications to ensure that the proper material has been delivered to the Site;
- iv) inspection of materials after they have been installed to ensure that it has not been damaged during installation;
- v) A pre-construction inspection will be performed prior to beginning work on any work task. A pre-construction inspection will include the following:
  - a review of contract requirements to ensure that all materials and/or equipment have been tested according to applicable standards and specifications,
  - ensure that provisions have been made to provide required quality control testing, and
  - examination of the work area to ascertain that all applicable preliminary work tasks have been completed;
- vi) General inspections will be performed periodically as the amount of work completed warrants an inspection. A general inspection will include the following:
  - examination of the quality of workmanship,
  - testing of materials for compliance with Contract requirements,
  - any omissions, and
  - general progress of work performed; and
- vii) A final inspection will be performed upon completion of each work task to ensure compliance with the Construction Drawings and

Construction Specifications and to ensure that deficiencies identified in the general inspections have been corrected.

These inspections will be performed by the Resident Engineer and the results of the inspections will be provided in the final construction report. USEPA and OEPA representatives will be notified by the Resident Engineer at least 3 days in advance of any final inspections. The results of all inspections will be recorded in the daily Site log book as described in Section 7.0. Copies of the pre-construction, general and final inspection reports will be provided to SNFT and all parties involved in the inspection.

The components of each work task to be inspected, the types of inspections required and the frequency of the inspections are summarized in Table 6.1.

### 6.3 TESTING

In addition to the daily inspections of the construction progress, material testing will be carried out as required. Material testing will be performed to ensure compliance with material specifications and design criteria as presented in the Construction Specifications.

The testing requirements, methods of testing, testing frequency for each of these work task components and submittals (test reports, certificates verifying material quality/workmanship, etc.) are summarized in

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS  
GROUNDWATER EXTRACTION SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Inspected</i>	<i>Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Submittals to Resident Engineer</i>
<b>A. Buried Conduits</b>				
• Depth and Alignment of Excavation	• has trench been excavated to design elevation and line	• survey	• intermittent during excavation	• final elevations, grades and alignment
• High Density Polyethylene Pipe (HDPE)	• do pipe and fittings meet specifications	• check supplier's specifications	• upon delivery to site	• manufacturer's certification
	• has pipe been laid to design depth	• survey	• continuous during excavation	• elevations
	• has pipe been damaged or filled with soil during installation	• visual	• continuous during excavation and at end of installation	• none
• Granular Bedding Material	• does bedding material meet gradation specifications	• check supplier's gradation	• prior to delivery on Site	• grain size distribution curves
• Imported Backfill	• does imported backfill meet specifications	• check supplier's specifications	• for each source of material prior to delivery to site	• certification and test results
	• is stockpile being properly stored and handled	• visual	• continuous	• none
	• does backfill meet gradation specification	• if backfill is imported check supplier's gradation • if on-site backfill is used, conduct gradation test	• prior to delivery to site • minimum of 1 test per 5,000 cu yd of material removed at source	• grain size distribution curves • grain size distribution curves
	• does backfill contain unsuitable materials:	• visual and laboratory	• minimum 1 test per 5,000 cu yd of material removed at source.	• certification and test results
	1. material containing loam, roots or organic matter; 2. frozen material or material containing snow or ice; 3. clays which are classified as inorganic clays of high plasticity in accordance with ASTM D2487; 4. soft and/or organic clays and silts of low strength; 5. frost susceptible silts or clays; 6. swelling clays;			

TABLE 6.1

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS  
GROUNDWATER EXTRACTION SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Inspected</i>	<i>Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Submittals to Resident Engineer</i>
<ul style="list-style-type: none"> <li>Imported Backfill (cont'd)</li> </ul>	<ol style="list-style-type: none"> <li>rock and lumps of material with dimensions greater than six inches for backfill of deep excavation areas or 1/2 inch for backfill of the upper six inches of any excavation area, measured through any axis before compaction;</li> <li>trees, stumps, or any other wood or lumber;</li> <li>wire, steel, cast iron, cans, drums or any other foreign materials; and</li> <li>materials containing hazardous or toxic constituents at hazardous or toxic concentrations.</li> </ol>			
<ul style="list-style-type: none"> <li>Native Fill</li> </ul>	<ul style="list-style-type: none"> <li>does native fill contain unsuitable materials:               <ol style="list-style-type: none"> <li>frozen material or material containing snow or ice;</li> <li>rocks and lumps of material with dimensions greater than specified layer thickness before compaction; and</li> <li>other deleterious or foreign matter detrimental to the use intended.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>visual</li> </ul>	<ul style="list-style-type: none"> <li>daily</li> </ul>	<ul style="list-style-type: none"> <li>none</li> </ul>
<ul style="list-style-type: none"> <li>Storage and Handling of Backfill</li> </ul>	<ul style="list-style-type: none"> <li>are stockpiles free of foreign materials</li> <li>are stockpiles far enough apart to prevent intermixing</li> </ul>	<ul style="list-style-type: none"> <li>visual</li> <li>visual</li> </ul>	<ul style="list-style-type: none"> <li>daily</li> <li>daily</li> </ul>	<ul style="list-style-type: none"> <li>none</li> <li>none</li> </ul>
<b><i>B. Manholes and Wet Well</i></b>				
<ul style="list-style-type: none"> <li>Common Backfill</li> </ul>	<ul style="list-style-type: none"> <li>see Section A. Buried Conduits</li> </ul>			
<ul style="list-style-type: none"> <li>Excavation</li> </ul>	<ul style="list-style-type: none"> <li>does excavation meet design specifications</li> </ul>	<ul style="list-style-type: none"> <li>measure layout and depth</li> </ul>	<ul style="list-style-type: none"> <li>upon completion</li> </ul>	<ul style="list-style-type: none"> <li>elevations</li> </ul>
<ul style="list-style-type: none"> <li>Precast Concrete Chambers and Appurtenances</li> </ul>	<ul style="list-style-type: none"> <li>do manhole frames and appurtenances meet design specifications</li> </ul>	<ul style="list-style-type: none"> <li>check supplier's specifications</li> </ul>	<ul style="list-style-type: none"> <li>14 days prior to delivery to Site</li> </ul>	<ul style="list-style-type: none"> <li>manufacturer's certification</li> </ul>
<ul style="list-style-type: none"> <li>Manhole Frame</li> </ul>	<ul style="list-style-type: none"> <li>does manhole frame leak</li> <li>are manholes installed to grade and plumb</li> </ul>	<ul style="list-style-type: none"> <li>leakage test</li> <li>survey</li> </ul>	<ul style="list-style-type: none"> <li>upon installation</li> <li>upon installation</li> </ul>	<ul style="list-style-type: none"> <li>test results</li> <li>final elevations</li> </ul>

TABLE 6.1

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS  
GROUNDWATER EXTRACTION SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Inspected</i>	<i>Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Submittals to Resident Engineer</i>
• Grout	• does grout meet specifications	• check suppliers specification	• upon delivery to Site	• certification
• Concrete	• see Section C. Extraction Wells, Monitoring Wells and Piezometers			
• Gravel Base	• does gravel meet gradation specifications	• check supplier's gradation	• prior to delivery to Site	• grain size distribution curve
	• does compacted gravel meet design thickness	• visual (grade stakes) or survey	• upon completion	• measurements
• Granular Backfill for Manhole Frames	• does granular backfill meet gradation specification	• check gradation from supplier	• prior to delivery to Site	• grain size distribution curve
<b>C. <u>Extraction Wells, Monitoring Wells and Piezometers</u></b>				
• Depth	• does well depth meet design specifications	• visual logging of well cuttings	• continuous	• well drilling log
		• depth measurement	• periodic and on completion	• well drilling log
• Cement	• does cement meet specifications	• check supplier's specifications	• upon delivery to Site	• certification
• Aggregate	• does aggregate meet specifications	• check supplier's specifications	• upon delivery to Site	• certification
• Water	• does water meet specifications	• check supplier's specifications	• upon delivery to Site	• certification
• Admixtures	• does admixture meet specifications	• check supplier's specifications	• upon delivery to Site	• certification
• Concrete	• does concrete meet design specifications	• visual (tape measurement)	• during concrete placement	• final dimensions
	• does concrete mixture meet design specifications	• check supplier's specification	• upon delivery to Site	• mixture certification
• Chambers	• do chambers meet specifications	• check manufacturer's specifications • measurement	• upon delivery to Site • upon delivery to Site	• manufacturer's certification • none
• Grout	• see Section B. Manholes and Wet Well			
• Well Screens	• do well screens meet specification	• check manufacturer's specifications	• upon deliver to Site	• certification
• Casings	• do casings meet specifications	• check manufacturer's specifications	• upon deliver to Site	• certification
• Silica Sand	• does gradation meet specifications	• check supplier's specifications	• upon deliver to Site	• certification
• Sampling	• See Draft Operation, Maintenance and Monitoring QAPP			

TABLE 6.1

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS  
GROUNDWATER EXTRACTION SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Inspected</i>	<i>Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Submittals to Resident Engineer</i>
<b>D. <u>Pipe and Media Drain</u></b>				
• Depth and Alignment of Excavation	• see Section A. Buried Conduits			
• Perforated High Density Polyethylene Pipe (HDPE)	• see Section A. Buried Conduits			
• Granular Bedding Material	• see Section A. Buried Conduits			
	• check cover and depths	• visual (measurement)	• continuously during installation	• record drawings
• Granular Media Drain Material	• does backfill meet gradation specification	• check gradation from supplier	• prior to delivery to Site	• grain size distribution curve
• Geotextile Filter Fabric	• check suppliers specifications	• visual	• upon delivery to Site	• manufacturers certification
• Imported and Native Backfill	• see Section A. Buried Conduits			
<b>E. <u>Mechanical Components of Wells and Manholes</u></b>				
• Installation of Gate Valves, Pumps, Pipe and Fittings, Flow meters, Flow Control Valves, etc.	• do specifications of mechanical components meet design specifications	• check supplier's specifications	• upon delivery to Site	• manufacturer's operating and maintenance literature
	• are mechanical components being assembled according to specifications	• visual	• continuously during assembly	• shop drawings • confirmation in writing that equipment was satisfactorily tested
<b>F. <u>Electrical Components</u></b>				
• Installation of Panelboards, Electrical Cable, Control Wire, Suspended Electrodes, Liquid Level Switch, etc.	• do specifications of electrical components meet design specifications	• check supplier's specifications	• upon delivery to Site	• Certificate of Acceptance
	• are electrical components being assembled according to specifications	• visual	• continuously during assembly	• test results upon successful completion of installation
• Pull Boxes	• do pull boxes meet design specifications	• visual	• upon delivery to Site	• none
• PVC Electrical and Control Conduits	• do conduits meet specifications	• check supplier's specifications	• upon delivery to Site	• manufacturer's certification

TABLE 6.1

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE INSPECTIONS  
GROUNDWATER EXTRACTION SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Inspected</i>	<i>Items to be Checked During Inspection</i>	<i>Type of Inspection</i>	<i>Frequency of Inspection</i>	<i>Submittals to Resident Engineer</i>
<b><i>G. South and East Ditch</i></b>				
• Depth and Alignment of Excavation	• see Section A. Buried Conduits			
• Native Soil	• is there any loose soil on subgrade	• visually check condition of subgrade	• continuously during construction	• none
• Gravel Base	• see Section B. Manholes and Wet Well			
• Riprap	• does rip rap bedding thickness meet design specification	• visual (tape measurement)	• continuously during construction	• thickness
	• does riprap gradation meet design specifications	• check supplier's specifications	• prior to delivery to Site	• grain size distribution curve
• Geotextile Filter Fabric	• see Section D. Pipe and Media Drain			
<b><i>H. Security Fence</i></b>				
• Chain Link Fence	• does installation and material meet with stipulated specifications	• check supplier's specifications • visual	• upon delivery to Site • continuous during installation	• manufactures certification • record drawings
• Concrete	• see Section C. Extraction Wells, Monitoring Wells and Piezometers			
<b><i>I. Contaminated Soil and Sediment Removal</i></b>				
• Sediment Removal	• has two feet of sediment been removed from pond	• survey	• continuous during excavation	• pre and post levels
• Soil Removal	• has two feet of soil been removed from contaminated grids	• survey	• continuous during excavation	• pre and post levels
<b><i>J. Final Site Cover</i></b>				
See RC QAPP for Site Cover				

TABLE 6.2

Page 1 of 2

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE TESTING  
GROUNDWATER EXTRACTION SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Tested</i>	<i>Type of Test</i>	<i>Testing Standard</i>	<i>Frequency of Test</i>	<i>Criteria</i>
<b>A. Buried Conduits</b>				
• Forcemain High Density Polyethylene Pipe (HDPE)	• Hydrostatic	• NA	• each test shall not exceed 1,500 feet of piping unless otherwise authorized by CRA	• amount of make-up water added should not exceed 0.25 gallons per 100' of pipe at test pressure of 100 psi
	• Flushing	• NA	• each test shall not exceed 1,500 feet of piping unless otherwise authorized by CRA	• flush until all foreign material is removed
• Common Backfill	• Maximum Dry Density	• ASTM D698 and ASTM D2216	• minimum of 1 test for each change in material	• N.A.
	• Gradation	• ASTM D422 or ASTM D1140 as appropriate	• minimum of 1 test per 5,000 cu yd of material removed at source	• under lawn-seeded areas minimum 90% Standard Proctor Density
			• minimum of 1 test for any change in material used in fill	• >25% wt < 0.005 mm $\phi$ particle size; ≥55% wt passing No. 200 sieve
	• Moisture Content	• ASTM D3017		
	• Bulk Density	• ASTM D1556 or ASTM D2167 or ASTM D2922, whichever is appropriate	• minimum 1 test per 2,000 cu. yd.	
<b>B. Manholes and Wet Well</b>				
• Pipes, Valves, Fittings, Connections, etc.	• Leakage	• NA	• after installation and after any repairs	• minimum fluctuation of 5 psi at 140 psi applied pressure, over 1 hour
	• Hydrostatic	• NA	• after installation and after any repairs	• minimum fluctuation of 5 psi at 140 psi applied pressure, over 1 hour
• High Density Polyethylene Pipe (HDPE)	• See Section A. Buried Conduits			
• Precast Concrete Chambers	• Leakage	• NA	• after installation and after any repairs	• leakage ≤0.3% vol/hr



TABLE 6.2

**SUMMARY OF CONSTRUCTION QUALITY ASSURANCE TESTING  
GROUNDWATER EXTRACTION SYSTEM  
SUMMIT NATIONAL SUPERFUND SITE**

<i>Work Task Component to be Tested</i>	<i>Type of Test</i>	<i>Testing Standard</i>	<i>Frequency of Test</i>	<i>Criteria</i>
<b>C. <u>Pipe and Media Dens</u></b>				
• Granular Backfill	• Dry Density	• ASTM D698, Ohio Dot Size No. 89	• minimum 1 test per 2,000 cu. yd.	• minimum 90 - 95% Standard Proctor Density to bottom of existing ditch
• Common Backfill	• See Section A. Buried Conduits			
<b>D. <u>Monitoring Wells, Extraction Wells and Piezometers</u></b>				
• Casing	• Leakage	• NA	• for each hole drilled	• no leakage for five minutes
<b>E. <u>Final Soil Cover</u></b>				
• Loam Soil	• See Section A. Buried Conduits			
	• Permeability	• ASTM D2434	• minimum 1 test per 2,000 cu. yda. • minimum 1 test for any material change	• $1 \times 10^{-4}$ cm/s

Notes :

NA Not Applicable

Table 6.2 and have been incorporated into the construction specifications for the groundwater extraction system.

## 7.0 COA DOCUMENTATION

### 7.1 GENERAL

This section details the documentation requirements for the RC QAPP. The proper, thorough, and accurate documentation of all CQA site activities is important in ensuring quality installation. CQA testing will be documented daily.

### 7.2 CONTRACTORS DAILY SITE LOG BOOK

The selected remedial contractor will record daily quality control activities in a Daily Site Log Book to be kept on Site at all times. The log book will include the following information:

- i) date, weather conditions;
- ii) all Site activities;
- iii) decisions made regarding approval of units of material or of work, and/or corrective actions to be taken in cases of substandard quality;
- iv) submittals made by suppliers verifying material quality;
- v) quality control test and inspection results;
- vi) construction delays, and causes;
- vii) areas affected by delays;
- viii) construction problems and corrective actions;
- ix) personnel on Site;
- x) present phase of construction;

- xi) material and/or equipment delivered to site (including equipment demobilization);
- xii) inspections made;
- xiii) health and safety considerations;
- xiv) quality control tests performed and results of tests taken on previous work day;
- xv) instructions given by the Resident Engineer;
- xvi) changed conditions/conflicts encountered; and
- xvii) remarks.

Each daily entry into the log will be signed by the remedial contractor as verification to its correctness, and a copy of the signed entry will be provided to the Resident Engineer on a daily basis for verification. An example of this report sheet is presented in Appendix A. The Contractor may use alternate forms providing the same information, subject to the approval of the Resident Engineer.

### 7.3 COA INSTRUMENT CALIBRATION

The CQA support personnel will record calibrations of test equipment in an Instrument Calibration Log Book, maintained on Site by the Resident Engineer. Actions taken as a result of recalibration will be recorded in the Inspection log book, as described in the next section.

#### 7.4 INSPECTION LOG BOOK

All observations and quality control field tests will be recorded by the CQA support personnel into Inspection Log Books. These books will be kept on Site and maintained by the Resident Engineer. The inspection log book will include the following information:

- i) date, time, weather conditions;
- ii) description or title of the inspection activity;
- iii) location of the inspection activity or location from which the sample increment was obtained;
- iv) type of inspection activity and procedure used (reference to standard method when appropriate);
- v) recorded observation or test data, with all necessary calculations;
- vi) results of the inspection activity and comparison with specification requirements;
- vii) personnel involved in the inspection activity; and
- viii) signature of the appropriate CQA inspection personnel and concurrence by the Resident Engineer.

Items above shall be formulated into checklists so that details are not overlooked.

## 7.5 PROBLEM/CORRECTIVE ACTION REPORTS

A problem is defined as material or workmanship that does not meet the construction specifications. Problem/Corrective Action Reports should be cross-referenced to specific inspection entries in the Inspection Log Book where the problem was identified. Problem/Corrective Action Reports will include the following information:

- i) unique identifying sheet number for cross-referencing and document control;
- ii) detailed description of the problem;
- iii) location of the problem;
- iv) probable cause;
- v) how and when the problem was located (reference to Inspection Log Book);
- vi) estimation of how long problem has existed;
- vii) suggested corrective action;
- viii) documentation of correction (reference to Inspection Log Book);
- ix) final results;
- x) suggested methods to prevent similar problems; and
- xi) signature of the appropriate CQA support personnel and concurrence by the Resident Engineer.

In some cases, not all of the above information will be available or obtainable. However, when available, such efforts to document problems could help to avoid similar problems in the future.

## 7.6 WORK TASK REPORTS

Within each work task, there may be several quality characteristics, or parameters, that are specified to be observed or tested, each by a different observation or test, with the observations and/or tests recorded in different Inspection Log Books. At the completion of each task, these log books should be used to write a Work Task Report summarizing all of the construction activities related to that particular work task.

Work Task Reports will be prepared by the Resident Engineer or the Project Coordinator and will include the following information:

- i) unique identifying sheet number for cross-referencing and document control;
- ii) description of work task (i.e., installation of underground forcemain, construction of pipe and media drain, etc.);
- iii) quality characteristic being evaluated and references to construction specifications and plans;
- iv) quality control test locations;
- v) inspections made (define procedure by name or other identifier);
- vi) summary of inspection results, which will include all data outside acceptable limits, and documentation of corrective action and retest results;
- vii) define acceptance criteria (compare task inspection data with design specification requirements; indicate compliance or noncompliance; in

the event of noncompliance, identify documentation that gives reasons for acceptance outside of the specified design); and  
viii) signature of the Resident Engineer or Project Coordinator.

## 7.7 FINAL REPORT

At the completion of the remedial construction, CRA will prepare and submit a final report to USEPA, OEPA and SNFT. This report will include copies of all of the Daily Site Log Books, Inspection Log Books, Problem/Corrective Action reports, deviations from design and material specifications (with justifying documentation), and as-constructed drawings.

The final report will re-emphasize that areas of responsibility and lines of authority were clearly defined, understood, and accepted by all parties involved in the project. Signatures of CRA's Project Coordinator and Resident Engineer should be included as confirmation that each party understood and accepted the areas of responsibility and lines of authority and performed their functions in accordance with the RC QAPP.

## 7.8 STORAGE OF RECORDS

During remedial construction the Resident Engineer will maintain a copy of the Construction Drawings and the Construction Specifications, RC QAPP and Problem/Corrective Action reports in the Site office. Once the remedial construction is complete, all CQA documents



(originals) will be retained by CRA, and a copy sent to SNFT. This information will be kept until all operating and post closure monitoring periods have expired as specified in the Consent Decree.

APPENDIX A

TYPICAL CONTRACTORS DAILY SITE LOG BOOK

## TYPICAL CONTRACTORS DAILY SITE LOG BOOK

Project Name: Construction of Groundwater Extraction System Date: \_\_\_\_\_

Summit National Superfund Site

Weather: \_\_\_\_\_ Report No. \_\_\_\_\_

1) Personnel On Site

a) CRA

b) Contractor

c) Subcontractor

d) Other

2) Phases of Construction in Progress (Give briefly only phase or phases of work in progress)

3) Health and Safety

a) Preparatory

b) Initial

c) Follow-up

4) Material and/or Equipment on-Site (Including equipment demobilization)

5) Inspection Made (Include negative inspections, phase of in-progress construction work inspected and all deficiencies noted during inspections)

6) Tests Performed and Results of Tests (including results of tests taken on previous dates).

- 7) Instructions Received (List any instructions given by Resident Engineer on construction deficiencies, retesting required etc., with action to be taken).
- 8) Changed Conditions/Conflicts Encountered.
- 9) Remarks

SIGNATURE \_\_\_\_\_

TITLE \_\_\_\_\_

\_\_\_\_\_

Contractor's Verification: The above report is complete and correct and all material and equipment used and work performed during this reporting period are in compliance with the construction plans and specifications except as noted above.

\_\_\_\_\_

Contractor's Approved Authorized Representative